REACH OUT
shaping climate resilient cities

# The Triple-A Toolkit: achievements and exploitation

## D3.10. Report documenting the generic methodology of the toolkit, lessons learnt and recommendation on further exploitation and development.

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The REACHOUT project has received funding from the European Union's Horizon research and innovation programme under grant agreement No 101036599.

Grant agreement No: 101036599

# D3.10 Generic methodology of the toolkit, lessons learnt and recommendation on further innovation exploitation on tool and developments

Work Package: WP3

Due date of deliverable: M40

Actual submission date: 10 March 2025

Start date of project: 1 October 2021

Lead beneficiary for this deliverable: Tecnalia

Contributors: Deltares, CMCC, CAS, UCC, IVM

| **Dissemination Level** | | |
|---|---|---|
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**Version Log**

| Version | Date | Released by | Nature of Change |
|---|---|---|---|
| 0.1 | 10-12-2024 | Tecnalia | Document creation |
| 0.2 | 21-01-2025 | Tecnalia | Draft version 1 – to be complemented |
| 0.3 | 28-01-2025 | Deltares, CAS | Contributions and feedback |
| 0.4 | 31-01-2025 | Tecnalia | Final Version |
| 0.5 | 15-02-2025 | Deltares, CAS | Contributions and feedback |

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|---|---|---|---|
| 1.0 | 07-03-2025 | Tecnalia | Final consolidated version |

# Abstract

This report presents the final result of the toolkit development as part of the REACHOUT project, which culminated in the creation of the Triple-A Toolkit (https://triple-a-toolkit.eu) . This report showcases the Triple-A Toolkit achievements, including its ability to provide cities with a practical and effective approach (Triple-A framework) to urban adaptation. By documenting the toolkit's development, testing, and application in seven city hubs across Europe, this report aims to support the further exploitation and development of the Triple-A Toolkit, ultimately contributing to the enhancement of urban climate resilience.

# Table of contents

# 1 Introduction

## 1.1 Context

The REACHOUT project has co-developed and tested urban climate services together with end-users in 7 city hubs within Europe. The overarching aim was to innovate and broaden the existing offer of climate services and tools and increase their relevance for decision making, access and uptake. Over the 3,5-year duration of the project two work packages were central to this effort:

- The work package on toolkit development (WP3) has innovated and developed a series of tools and made them available to a large group of users through a web-based platform, the triple-A toolkit.
- These innovations and developments were informed by user needs and tested in the 7 city hubs in three agile development cycles in the work package on service delivery (WP2).

The current report (D3.10) is presenting the final result of the toolkit development. It is documenting the generic methodology of the toolkit and what has been achieved in terms of innovation and development. It presents lessons learnt on the development process and provides recommendation on how the toolkit can be further exploited and what future developments are recommended.

Parallel to this report (D2.8) “Final recommendations on service delivery” presents the final recommendations on service design and development (lessons learnt) based on the city experiences in co-developing and using the triple-A tools. It evaluates user satisfaction and identifies key 'do's and 'don'ts' through questionnaires and in-depth interviews with city-hubs users.

## 1.2 REACHOUT Triple-A framework and toolkit

The triple-A framework is the overall framework that has structured the climate service development and delivery in the project. In this way it is also part of the main generic method of the toolkit.

The REACHOUT Triple-A framework was built upon the proven approach applied in the Delta Program on regional spatial adaptation, developed in the Netherlands[1]. This approach was designed to help cities and regions enhance their climate resilience taking them through 3-steps: i) Analysis – understand the climate impacts and risk; ii) Ambition – have a dialogue with stakeholders to prioritise risk and set ambition for adaptation; iii) Action – set up a climate action plan to meet ambition. Ultimately almost all Dutch municipalities applied this adaptation planning approach, supported by consultants and a national climate services platform.

The REACHOUT Triple-A framework structures urban adaptation and resilience efforts into the same three key steps: Analysis, Ambition, and Action, with enabling conditions supporting the entire process.

[1] Island-level adaptation - Spatial adaptation

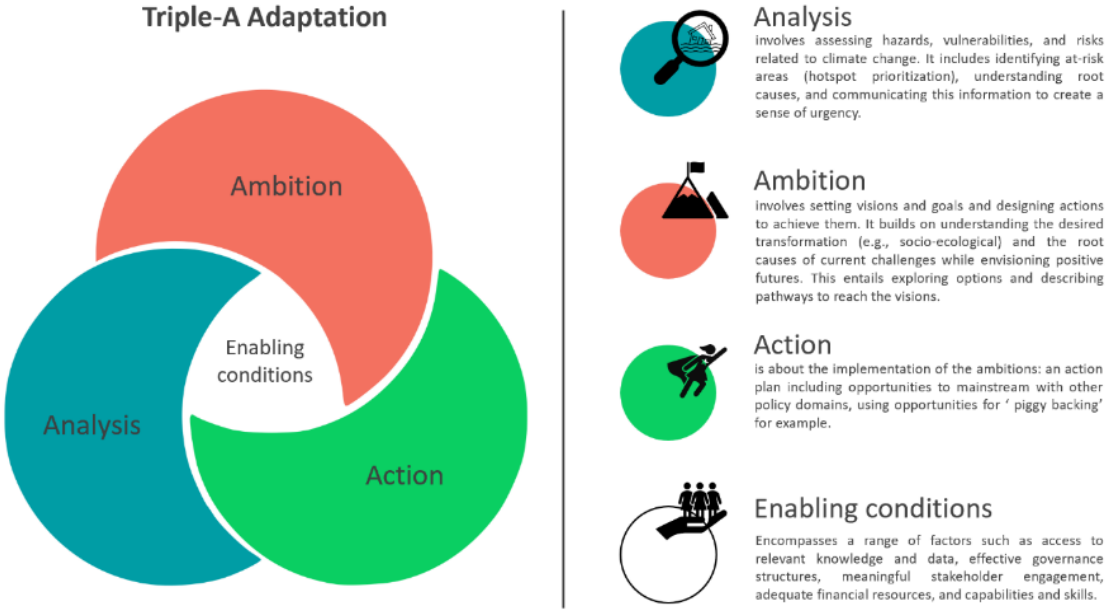


Figure 1. The Triple-A framework for adaptation

**Analysis** involves assessing the current and future climate risks: by a better understanding of hazards, exposure, vulnerabilities and different type of impacts. It also includes identifying at-risk areas (hotspots), understanding root causes, and co-creating this information with citizens and stakeholders and create a sense of urgency. Monitoring and evaluation are key to analyse and assess the feasibility and effectiveness of actions and learn and adjust the course as necessary to achieve the desired goals.

**Ambition** focuses on setting priorities and agendas by prioritising vulnerabilities and risks and developing ambitious adaptation strategies based on positive future visions (*"future we want)".* It involves setting visions, goals, and targets, and establishing values and criteria for prioritising measures. Ambition is essential for transformative change. It includes setting and adjusting concrete goals, such as increasing green spaces or reducing unpaved areas. Ambition setting is a vital component for targeted monitoring as without clear goals it is impossible to monitor adaptation.

**Action** entails undertaking the necessary measures to achieve the desired objectives. This involves preparing and implementing adaptation actions to reduce climate risk, considering specific contexts and limitations. Action includes deciding on short, medium, and long-term actions, integrating with other policy domains, and facilitating or stimulating other stakeholder (or other departments of the municipality) to implement parts of the ambition.

**Enabling conditions** refers to the key factors and circumstances that facilitate the successful development and implementation of adaptation strategies. In REACHOUT, several key enabling conditions have been identified that will enhance the impact of the analysis, ambition setting, and action planning:

- **Develop a clear communication strategy**. Effectively communicating the outcomes of analysis, ambition and action is crucial to raise awareness, engaging citizens and stakeholders, and to ensuring that adaptation planning is widely understood and remains relevant.
- **Co-creation as core approach to enhance engagement, collaboration and development of climate services**: Co-develop user-oriented tools supporting climate services to effectively inform decision-making. Co-development increases the

relevance and usability of climate services, improves trust and collaboration among stakeholders.

- **Leverage adaptation governance:** Setting up dedicated adaptation teams that involve relevant stakeholders and creating structures for streamlined coordination and collaboration—both within municipalities and across different governance levels—are key to supporting the development and implementation of adaptation policies, goals, strategies, and plans.

Triple-A framework aims to accelerate urban adaptation by providing cities with a coherent and easy-to-use structure, helping them to increase climate resilience in different ways.

A key feature of the Triple-A approach is its simplicity and flexibility. The easily recognizable components do not follow a pre-defined order and can be adapted to the local context and specific needs, allowing cities to address unique challenges and pursue particular goals.

Another key element is its emphasis on ambition. The ambition component is encouraging cities to envision different futures and find ways to achieve them, moving from risk-based planning to climate-resilient development. Ambition setting can be done at different levels and with a different focus depending on city needs and context: strategic (vision, targets, motivation), technical (safety levels, risk prioritisation, measure selection criteria), and evaluation/adjustment (benefits, trade-offs, KPIs).

Finally, the learning process inherent to the application of the Triple-A approach is crucial. Regardless of how the components are combined, the approach fosters continuous learning, leading to diverse insights and outcomes that drive progress in urban adaptation and resilience. So, the Triple-A framework clusters activities in learning loops that help advancing in urban adaptation, making it flexible and modular, allowing multiple activities to happen simultaneously.

The Triple-A framework complements other frameworks, such as the Urban Adaptation Support Tool and the Regional Adaptation Support Tool.

## REACHOUT Triple-A Toolkit

The Triple-A toolkit is based on the **Triple-A framework**. The **Triple-A Toolkit** provides a flexible and modular platform for accessing and exchanging tailored tools supporting climate services. It offers access to tools-based services, city-hub' climate stories, best practices and learning modules to equip cities with the resources they need to better understand the risks and opportunities associated with climate change, prioritise adaptation measures, and develop effective adaptation strategies.

The Triple-A Toolkit includes features that facilitate the screening and selection of the most appropriate tools and services based on user needs, helping city planners and decision-makers understand which ones can best meet their specific requirements. Beyond this, the Triple-A Toolkit incorporates features that facilitate seamless connections between users and relevant partners who can provide expert guidance, technical support, or complementary services. This transforms the toolkit into a marketplace, serving as a dynamic platform that matches the demand for and supply of specialised climate services. By serving as an intermediary, the Triple-A toolkit not only simplifies the process of accessing and using climate services but also fosters cross-sectoral collaboration and building of a community of practice.

Both the Triple-A Toolkit and the framework have been iteratively updated and tested through several **iteration cycles** along the project duration within the REACHOUT city-hubs (See Chapter 2 and 3).

## 1.3 This report

This report describes the key achievements related to the triple-A approach, tool development and its operationalisation in the triple A toolkit.

A key achievement of the project lies in the Triple-A framework operationalization and testing, through discussions among partners how to frame and use the analysis, ambition and action steps. The Triple-A toolkit not only simplifies the process of accessing and using climate services but also provides a comprehensive understanding of both the lessons learned from real-world implementation and the tools developed to support cities at different maturity levels adopting the Triple-A framework.

The Triple-A toolkit is the sublimation of the Triple-A approach in web-based market place. It is designed to accommodate various entry levels for users, ensuring flexibility in meeting the unique needs of different urban contexts and challenges. At the core of this approach are the levels of complexity embedded in the tools, supported by category filters that allow users to navigate and find resources that match their specific needs. The demonstrators, showcasing the actual use of the triple-A tools in the seven cities, play a vital role in illustrating practical applications of the toolkit and its tools.

Another important achievement is the legacy of the Learning Program within the Triple-A Toolkit, rooted in its ability to empower cities to not only understand but integrate climate services and practices. The learning program outcome has been carefully designed and built based on the REACHOUT lessons learnt to provide step-by-step guidance, fostering capacity building for city officials and stakeholders. It also offers micro-learning pills and tailored REACHOUT resources to directly address the diverse urban challenges cities face.

Complementary to the Learning Program, an essential REACHOUT component has been the support from city liaisons and knowledge brokers, who have offered tailored and knowledge-informed services to ensure cities receive the expertise needed to navigate thought the tools and complex climate challenges. The role that the brokers and liaisons have played in the project has been translated into three types of consultancy services that can be given to cities in the exploitation of the Triple-A Toolkit, allowing cities to request these services as part of their resilience-building process.

Finally, the Triple-A Toolkit also recognizes the importance of different urban contexts and enabling conditions, adjusting its support to various entry levels. It connects closely with adaptation plans and urban challenges, encouraging cities to integrate these strategies with broader municipal areas, including alignment with UAST (Urban Adaptation Support Tool). This holistic approach ensures that the toolkit not only addresses immediate urban adaptation needs but also supports long-term sustainable development goals.

The report is structured in the following sections:

- **Section 1** provides an overview of this report and the rationale behind this work.
- **Section 2** provides an overview of how Triple-A framework has been further conceptualized within the project and how this journey played out for different cities.
- **Section 3** provides an overview of the final version of the Triple-A toolkit and a guidance on how to apply it in other cities, together with the lessons learnt along its application in REACHOUT cities.
- **Section 4** provides the individual tools evolution within REACHOUT lifetime based on the co-creation process applied with cities together with the tool innovation roadmap.
- **Section 5** provides a deeper understanding of the learning modules legacy as part of the triple-A toolkit
- **Section 6** provides the conclusion and further innovation/exploitation steps.

# 2 Conceptualization of the Triple-A framework

## 2.1 Triple- A framework conceptualization

During the REACHOUT project, the Triple-A adaptation framework, originally implemented in the Dutch Delta Program, evolved from its initial conceptual stages.

The approach has been further tested and refined by the REACHOUT project, drawing on its application in city hubs and informed by multiple internal and external dissemination workshops. These workshops were instrumental in validating the approach's relevance and gaining insights into the needs and expectations of end users.

The following aspects have been addressed:

- Developing a common understanding of the "Analysis – Ambition – Action" components to support climate adaptation planning and policy.
- Organize and integrate the components of 'Analysis – Ambition – Action' into the Triple-A toolkit, designed to effectively link urban adaptation and information services.
- Identifying gaps that need to be incorporated into the Triple-A approach.
- Determining how to effectively explain, facilitate, and support each stage of the process.

A key achievement of the project lies in its operationalization, testing, and discussions on ambition, which led to several notable improvements. These include a stronger connection between the root causes of risks and the exploration of actions—framing this exploration as part of ambition rather than action planning. Additionally, the project integrated resilient development into action planning and emphasized the importance of enabling conditions to support effective adaptation.

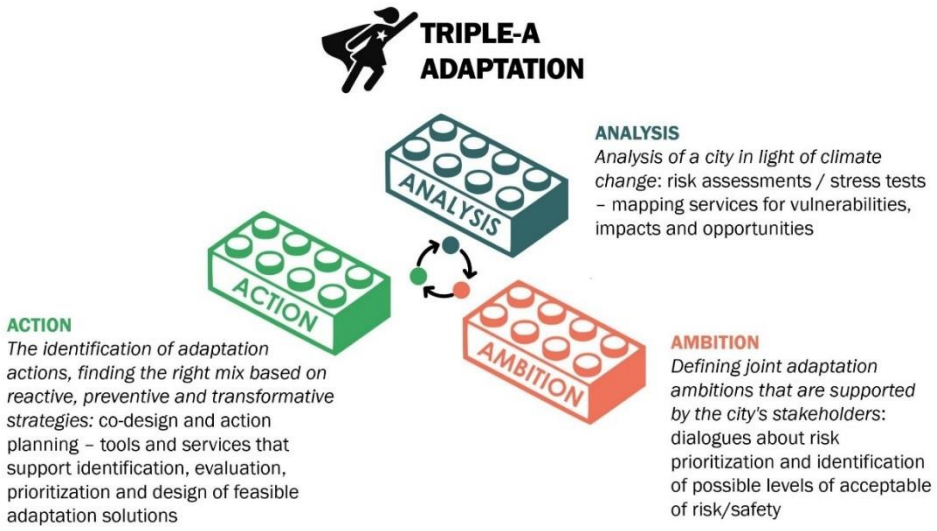


*Figure 2. Initial representation of the Triple-A adaptation framework*

The improvements of the Triple-A framework are also reflected by and the changes from the initial representation in the REACHOUT project proposal (Figure 2) to the latest version (Figure 1) are summarised as follows:

- The earlier version of the Triple-A framework focused on three distinct components (Analysis, Ambition and Action) without explicitly addressing the contextual factors that influence their interaction nor their uptake. In the latter version, the inclusion of “Enabling Conditions” highlights the key contextual factors (e.g. governance, stakeholder engagement, capacity building) that support the effective implementation of the framework. This addition recognizes that the success of adaptation effort relies not only on the technical aspects but also on the leveraging conditions that facilitate or hinder progress and ownership of climate action.
- The first version presented the components as building blocks, which may suggest a somewhat independent actions and thus, somewhat linear progression. To improve the communication of the Triple-A framework, the later version explicitly emphasises the interplay and iterative nature of the components. The Triple-A framework representation with overlapping areas suggests that these components are interdependent and operate in a continuous learning cycle, rather than as isolated steps.
- Higher emphasis on the stakeholder involvement is presented in the later version. While stakeholders are mentioned in the initial version, their roles are not fully developed. The inclusion of enabling conditions allow to explicitly include aspects like stakeholder collaboration, essential for co-creation of tools which has been a key activity within REACHOUT project, and capacity building. The latter image also allows to better recognise that inclusive processes are fundamental to achieving meaningful adaptation outcomes.
- The later version, as incorporates the enabling conditions within the framework it better expresses that the framework in not only diagnostic but also implementation-oriented, offering cities way to navigate challenges and seize opportunities more effectively.

In summary, the enhancements make the later version of the Triple-A framework more robust, holistic, and better equipped to address the complexities of urban climate adaptation. The addition of enabling conditions and iterative learning loops (see section 2.2) allows cities and regions to adapt dynamically to evolving needs and climate challenges while fostering long-term resilience.

## 2.2 Flexibility of the Triple-A framework to support cities at different maturity levels

The city hubs within REACHOUT have used the Triple-A framework in various ways, tailored to their specific needs and levels of maturity. A city like Logroño was really at the start of their adaptation journey. REACHOUT tools enabled putting adaptation on the internal agenda and helped to strengthen cross-collaborations within municipality. More advanced cities like Milan or Athens have used the Triple-A framework to further define policy targets and make better decisions to meet those targets. Both cities have upskilled their employees to ensure long-term use of the tools. The REACHOUT project worked through three loops each taking one year which forced the cities to work in this planning cycle. However, within city administrations, different policy domains have different planning cycles and deadlines, and different adaptation topics will be part of different policy plans. A heath plan may have a different timeline than the urban drainage plan.

In REACHOUT cities have followed Triple-A learning loops in well-defined cycles. Whereas in practise, different aspects have their own dynamics. A theoretical example of the implementation of the Triple-A framework is presented in Figure 3. As illustrated in the figure, the interplay between the Triple-A components (Analysis, Ambition, and Action) is flexible and

can be adapted as needed. The dialogue between different components in different phases provides valuable learnings.

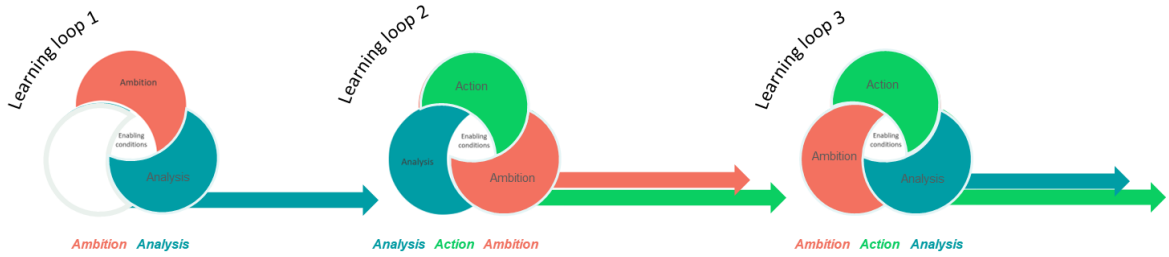


*Figure 3. Illustration of the Triple-A framework implementation*

- Learning loop 1: Cities identify gaps in their baseline information. This involves defining and engaging relevant stakeholders, such as community groups, local businesses, and government agencies to complete the baseline information. Based on this baseline data and stakeholder input, the key challenges and risk priorities that need to be addressed are identified.
- Learning loop 2: Once cities have conducted risk assessments and evaluated climate impacts, they can identify the most affected sectors, locations, and vulnerable populations, along with existing inequalities. With this insight, cities are empowered to set adaptation priorities, establish adaptation goals, and determine relevant measures to address anticipated climate change impacts. Building on the outcomes of the first learning loop, cities then gather updated information on the capabilities, roles, and commitments of key stakeholders, which is crucial for achieving adaptation goals.
- Learning loop 3: The third learning loop focuses on exploring adaptation options, assessing their characteristics and feasibility. Cities conduct monetary evaluations, such as cost-benefit analyses, to determine the most viable actions. They also identify stakeholders critical for implementation, monitoring, and learning. Additionally, cities work to understand the constraints or barriers, as well as the enablers, that could impact the achievement of their defined ambitions. This comprehensive evaluation helps cities make informed decisions and effectively implement their adaptation strategies.

In summary, the Triple-A framework serves as a dynamic and adaptable guide for cities as they navigate the complexities of urban adaptation. We acknowledge that adaptation activities are diverse by nature: adaptation is seldomly organized through a stand-alone department or policy plan. Often, adaptation is mainstreamed in different policy domains. Therefore, the Triple-A framework is modular and flexible, and the different activities of analysis, ambition and action are not always clearly structured and organized. By emphasizing the importance of analysis, ambition, and action, the framework fosters a continuous learning process that empowers cities to address climate challenges more effectively. Whether cities are in the initial stages of adaptation or refining their strategies, the Triple-A framework enables them to customise approaches to local contexts. It also promotes collaboration among diverse stakeholders, and foster ambitious, climate-resilient futures.

As cities progress through successive learning cycles, they not only enhance their resilience but also contribute to a broader understanding of their urban adaptation journey. This iterative approach creates a robust foundation for sustainable and resilient urban development.

### 2.2.1 Logroño's learning loops

The city of Logroño, Spain, has effectively implemented the Triple-A framework—Analysis, Ambition, and Action—to enhance its climate resilience. This approach has been executed through three iterative learning loops, each building upon the previous to foster continuous improvement in climate adaptation strategies. Through these iterative learning loops, Logroño has strengthened its capacity for climate adaptation, involving stakeholders in training sessions and co-design activities. The flexible and adaptable Triple-A framework has empowered the city to effectively navigate the complexities of urban adaptation, building a more resilient future.

- **Learning Loop 1: Mix of Analysis and leveraging enabling conditions.** In the initial phase, Logroño focused on the mapping of key stakeholders, including municipal departments and community representatives to build a common understanding on opportunities and risks of climate change (using the Climate Impact Diagrams tool). It was the first step to start the conversation about climate change adaptation and work towards a joint approach for taking climate measure and offering ideas for action. The city prioritized extreme heat events and pluvial floods as key challenges. assess heat risks, the Thermal Assessment Tool (TAT) was utilized to visualize past, present, and future heatwaves at Logroño and La Rioja region. The heat assessment was followed by mapping social vulnerability throughout the entire La Rioja region with the SVI-Tool. Additionally, the Social Vulnerability Index (SVI) Tool was employed to map social vulnerabilities across the city, ensuring that adaptation measures addressed the needs of the most susceptible populations. After having developed these assessments, a co-creation workshop was held in Logroño to validate the initial outcomes in terms of their usability and co-create meaningful and easy to understand visualizations and drawings for the draft version of the climate story. The climate story illustrates how heat and climate change impact the lives of vulnerable citizens, raising awareness about the urgency of climate resilience. It also highlights the actions currently being taken, or that can be taken, to mitigate these negative effects. The co-creation of the TAT and social vulnerability maps increased the uptake of the climate service while improving broader engagement.
- **Learning Loop 2: Mix of analysis and action.** In the second iteration, additional stakeholders were involved to discuss flood-related challenges and the goals for adaptation. Past and future pluvial flood maps were generated using the Pluvial Flood Tool to assess current and future flood risks in Logroño. The Pluvial Flood Tool provides a comprehensive assessment of pluvial flood risk for both the baseline situation and various nature-based adaptation strategies in Logroño, evaluating economic damages and population exposure. Additionally, Logroño explored various adaptation options, assessing their feasibility through tools like the Pluvial Flood Tool, which provided comprehensive assessments of current and future flood risks. This evaluation helped identify suitable locations for flood relief measures, such as raingardens, water ponds, and a green corridor. Additionally, in this second learning loop the land surface temperature maps outcomes were also produced as part of the Thermal Assessment Tool to characterize in this case heat phenomena at city level and spatially highlight areas of elevated land surface temperature during heat episodes in summer. These maps allow Logroño to better understand how land and urban morphology affect surface temperature and to identify hotspot areas for implementing heat reduction measures. These heatmaps were combined with the Social Vulnerability Index (SVI-Tool) maps developed at city level. This combination facilitates the identification of the hotspot considering the exposure and the vulnerability and it allows Logroño to start prioritizing the areas where to act in its climate adaptation process.

- **Learning Loop 3: Mix of ambition and action.** In this third iteration, the outcomes of the aforementioned tools were combined to identify suitable measures for adaptation while considering Logroño's broader development objectives through co-developing Climate Resilient Development Pathways (CRDP). The novel CRDP approach supports Logroño in planning actions across multiple time frames, outlining various pathways into the future by explicitly addressing the interactions between climate change adaptation, climate change mitigation, and sustainable development over time and under conditions of uncertainty. By accounting for these distinct but intertwined priorities, Logroño can flag potential trade-offs between needs and take advantage of synergistic actions. This assessment provides insights into how different measures complement each other or which ones would be most effective to achieve the desired objectives of Logroño.

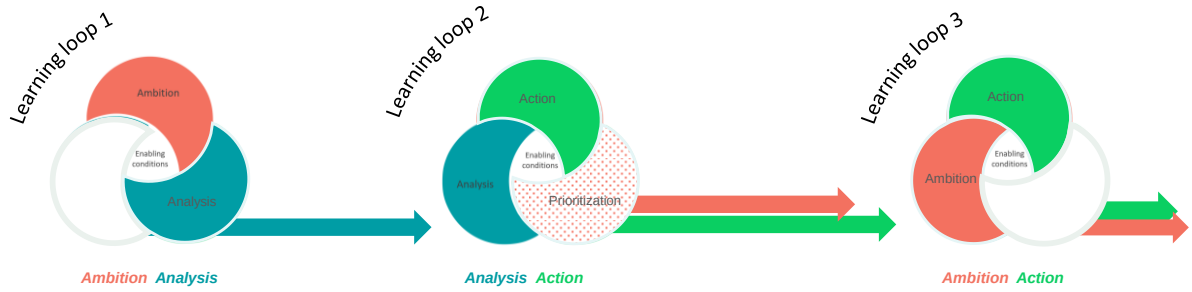


*Figure 4. Iteration cycles in Logroño following the Triple-A framework*

Along these iterations (or learning loops) Logroño's adaptation capacity has strengthened. The municipality as well as other city stakeholders have been involved in several training sessions, co-design activities and in the co-development of the city climate story. The latter has been a transversal tool to spread the message and the sense of urgency about climate action in Logroño.

Additionally, the municipality of Logroño developed the "Strategic Plans for Heatwaves" as part of their new urban strategy, 'Logroño Circular'. The strategic plans directly incorporated the heat and social vulnerability maps developed with the tools from the Triple-A Toolkit to spatially plan and implement proposed measures for coping with urban heat.

## 2.2.2 Athens' learning loops

Athens, the capital of Greece, is experiencing notable impacts from climate change, which has been affecting its weather patterns, ecosystems, and urban environment. Athens is facing more frequent and intense heatwaves, especially during the summer months. Average temperatures are rising, and periods of extreme heat have become more common, leading to higher risks of heat-related illnesses and deaths. The urban heat island effect (where urban areas are significantly hotter than surrounding rural areas due to human activities and infrastructure) is also exacerbating these temperatures. Additionally, the city is grappling with longer and more severe droughts. Water scarcity has not been observed over the last 30 years but should be explored given climate projections. Wildfires are happening in the periphery of Athens (Metropolitan Athens), Flash floods are also leading to pluvial flooding.

So, Athens has effectively implemented the Triple-A framework—Analysis, Ambition, and Action—to enhance its climate resilience through three iterative learning loops, each building

upon the previous to foster continuous improvement in climate adaptation strategies of the above-mentioned challenges.

- **Learning Loop 1: Pure Analysis phase.** Athens has been working on the heat stress in previous projects and has clear challenges regarding heat and flood. The resilience and sustainability department, wants maps for historical and projected heat, to make better, data-driven adaptation decision-making. So, in the first iteration the municipality focused mainly on analysis by using the Thermal Assessment Tool, to visualize past, present, and future heatwaves. They also wanted to understand the social vulnerabilities, so some socio-economic indexes were taken into account considering initial outcomes from the Social Vulnerability Tool, to overlay these with the heat analysis. This heat assessment led to the draft climate story focused on how heat and climate change impact the lives of vulnerable citizens in Athens.

- **Learning Loop 2: Mix of analysis and action.** In the second iteration, Athens' Resilience & Sustainability Department wanted to focus attention on high-resolution pluvial flood maps and hight resolution land surface temperature maps. So that flooding/heating hotspots within the city can be identified. The Pluvial Flood Tool was selected to develop flood maps and assess at a high-level opportunity in available green spaces. The Climate Resilient City Tool (CRCTool) was then used in a specific demonstrator location (Votris brownfield factory) to explore greening options and their potential impacts. The Thermal Assessment Tool was also used to develop high resolution land surface heat maps.

- **Learning Loop 3: Mix of ambition, action and analysis.** This iteration cycle was focused on integration. The land surface temperature maps were integrated in the CRCTool to visualize heat-stress areas and combine them with previous pluvial maps. Both the integration process and final outcomes have supported Athens to build capacity regarding maintaining and updating the tools and climate story and increasing collaboration between departments. The latter also created an opportunity to build connections to other projects (see Cooling Havens project that develops 5 green parks for heat mitigation) and create synergies between the REACHOUT tools and city efforts on adaptation. The workshops were very helpful in this regard, as well as tailoring the tools to specific requests of the city

The experience using the Triple-A framework for Athens meant that they want to embed these tools in their future practice – to the testament, the city purchased a large tablet to run CRCTool independently of the service provider (Deltares) and also purchased an ArcGIS story maps licence to continue producing such content.

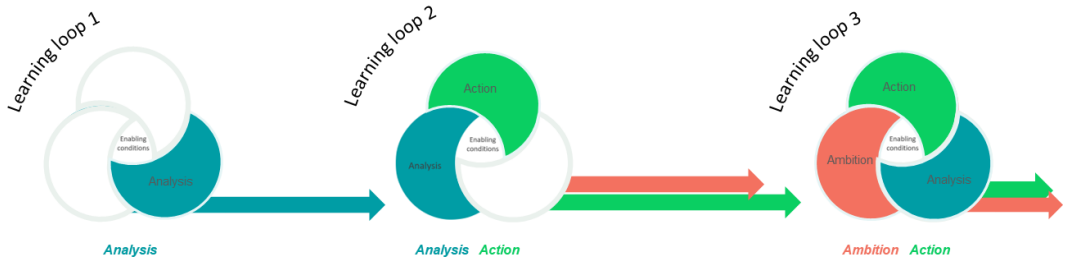


*Figure 5. Iteration cycles in Athens following the Triple-A framework*

# 3 Triple-A Toolkit implementation

The Triple-A toolkit's main aim is to support and inspire urban climate resilience solutions and narratives, primarily for city level civil servants and local consultants. The toolkit offers a wide range of tools, targeting the three main Triple-A components: “Analysis”; “Ambition"; and “Action”. The provided tools are underpinned by high-quality data sources and science-based methods and models. Guidance documents, narratives, climate stories and leading examples are offered as part of the toolkit to ensure its usability in practice.

The Triple-A toolkit particularly supports co-creating new narratives of climate resilient development, which are positive visions for attractive, safe, and thriving future cities by citizens, local companies, urban planners, ecologists, and climate service providers. The Triple-A toolkit requires updates to remain cutting-edge in the fast-evolving adaptation and resilience landscape. Therefore, the toolkit is designed as an agile catalogue that can be updated over time, in which users are directed to the desired tools in various user-friendly ways. Its ultimate goal is to remain operational beyond the duration of the REACHOUT project, enabling other EU-funded projects to integrate their tools and services into the toolkit.

Triple-A toolkit's main objective is to enhance the resilience of European cities to climate change by:

- Supporting the new, policy narrative of climate resilient development and transformation.
- Offering guidance on how to use the different tools of the toolkit and unlock different data sources.
- Responding flexibly to a changing climate services landscape.
- Being modular and possibly tailored to local use.
- Showcasing how the tools can be used for climate resilient development through attractive narratives using positive framing.
- Disclosing high quality open-source data sets and climate services outcomes.

The Triple-A Toolkit is supported and complemented by the methodological process (Triple-A framework) guiding how different tools and resources of the toolkit can be used within this framework and showcasing how this has been done in the REACHOUT 7 city-hubs.

The Triple-A Toolkit has been designed to be scalable, accommodating future expansion as new climate service providers join and additional functionalities are added. By serving as an intermediary, the Triple-A toolkit not only simplifies the process of accessing and using climate services but also fosters cross-sectoral collaboration and building of a community of practice.

## 3.1 REACHOUT Triple-A Toolkit overview

The Triple-A Toolkit is available in an independent server from the REACHOUT project website, at **Triple-A-toolikit.eu** to ensure its long-term sustainability and integration in other platforms. It provides a modular platform (See Figure 6) to help cities and regions enhance their climate resilience. The toolkit is flexible and adaptable to local contexts and encourages a learning process to continuously improve urban adaptation and resilience efforts.

## 3.1.1 REACHOUT Marketplace Landing page

The landing page of the Triple-A Toolkit has been redesigned to function as a 'marketplace' where demand meets supply. The text has been shortened and simplified for clarity. To make the landing page more intuitive and user-friendly, we have redesigned the entry points, which are now organized under the following categories: Home, *Tools and services, Tools in action, EU Framework, Build your skills on, FAQ and Contact*. The previous Lego-style blocks have been replaced with a more professional design.


*Figure 6. Triple-A Toolkit landing page.*

## 3.1.2 Tools and services

The Tools and Services tile offers a unique entry point to resources that allows cities to analyse the climate change and its impacts, set ambition goals with different tools and methods and to take climate action. The toolkit has several filters to help the user find the right solution to their needs such the phase of adaptation, the complexity of the resource or the hazard of interest. Users can filter tools also based on whether they are free, licensed or if they are looking for a consultancy service

These resources are designed to support the implementation of the Triple-A framework in cities, fostering urban resilience. In its final iteration, the toolkit consolidates this

comprehensive set of solutions, forming a robust marketplace aimed at enhancing the sustainability of urban development efforts.

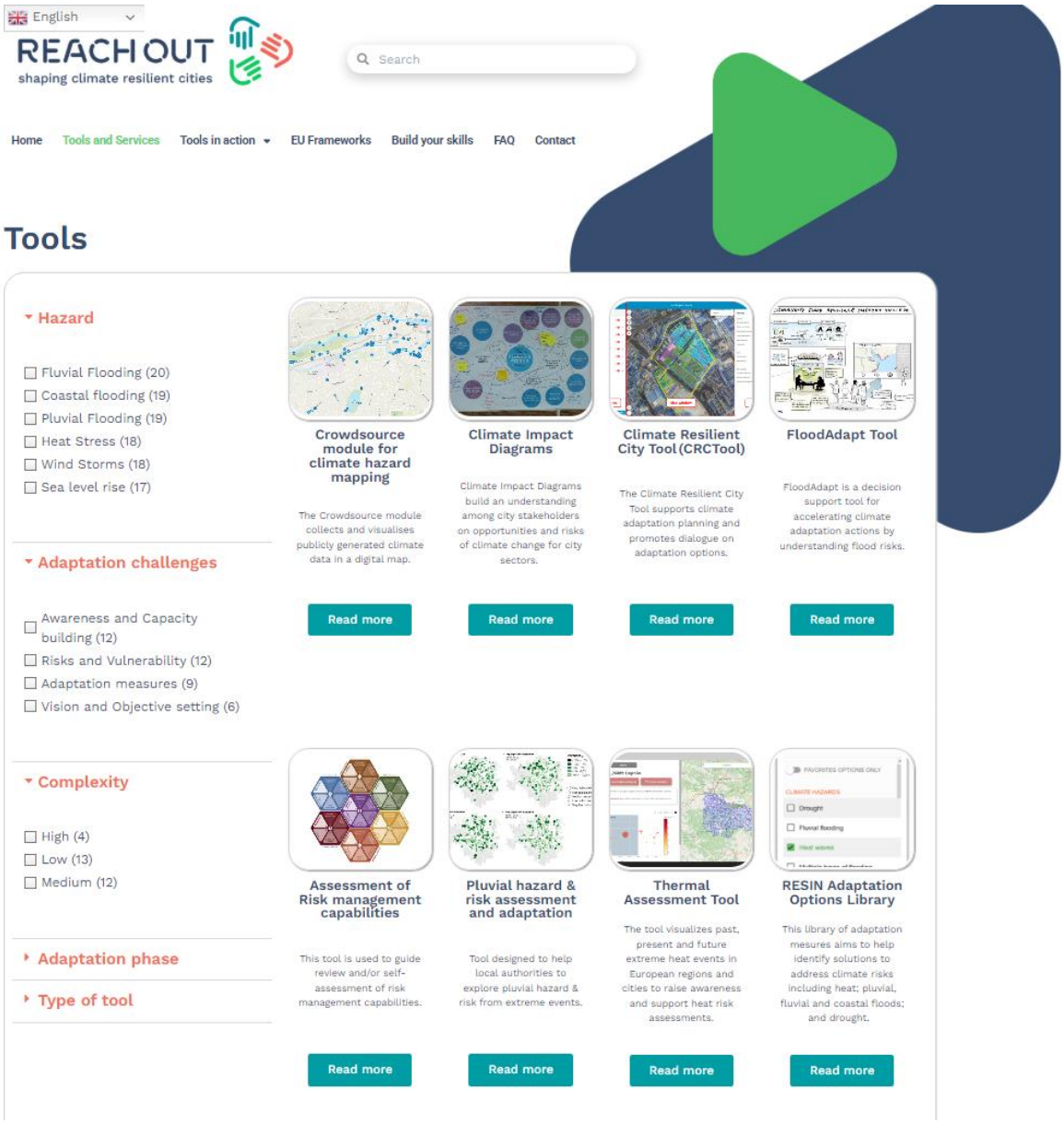


*Figure 7. Tools and services page with available drop list for each category filter*

Based on the selection made by the user, the resources available are listed in the right-hand side of the screen where they are very briefly presented with a sentence and further exploration of their detailed characterization is possible by clicking the interested tool or service (See figure below). Each tool is described by providing a short overview of the tool, examples based on the city-hubs experiences, general benefits of using the tool and how they tool can support analysis, ambition and/or action adaptation phases. Finally, it is also detailed the complexity of the tool (low, medium or high) explaining why.

English

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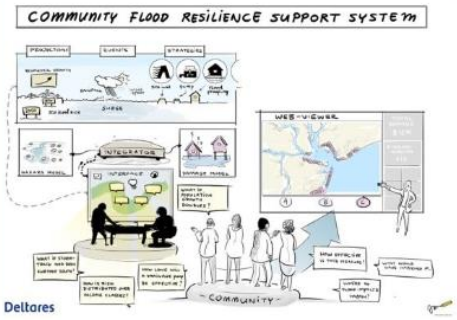
# FloodAdapt Tool




Deltares

## Tool description

The FloodAdapt tool is a decision support tool intended to accelerate climate adaptation actions by making it easier for local and regional agencies to understand their flood risk under different future conditions. FloodAdapt can be used to assess compound flooding, that means any combination of marine, rainfall and riverine flooding, with or without the added effects

Read more

## Complexity

The city needs data on topography, bathymetry and building assets and their potential maximum damage and flood damage functions for the initial set up of the tool in a new city.

## City Hub experiences

In Cork, the FloodAdapt tool has been set up to support the city council in its long-term flood risk management planning. This decision support system makes it easier to understand flood risk under different scenarios and test various adaptation options. The results can be used to inform adaptation pathways development.

## Benefits of using the tool

The tool aids long-term planning and climate adaptation goals of cities. It can be used, for example,

- to prioritize areas for flood risk adaptation,
- to develop flood-risk informed zoning plans,
- to pre-screen potential adaptation strategies, and

Read more

## Cost/effort for implementation

The tool needs to be configured for each location. A simple set up without validation of the underlying models can be made with ~2 person days. Pre-processing local data and calibrating the underlying models can take several person weeks.

## Triple-A phases

The tool can be used in the following Triple-A phases:

- Analysis phase: Impact assessments for status quo and different future scenarios
- Ambition phase: Prioritization of areas for adaptation
- Action phase: Screening and exploring different flood adaptation options, this is prior to and not instead of detailed feasibility and design studies for adaptation

## Guidance

Introduction to FloodAdapt: FloodAdapt Intro Video
User manual: Flood Adapt Documentation

## Contact

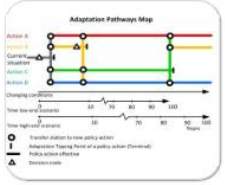
Gundula Winter
Deltares
gundula.winter@deltares.nl

## More information at

## Complementary tools

FloodAdapt can be used to assess the effectiveness of adaptation options and thus support the design of adaptation pathways.

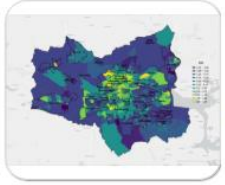
FloodAdapt can be used to aggregate flood impacts and risk for areas and groups and can link well with the Social Vulnerability Index Tool.




Adaptation Pathway Generator tool

Dynamic Integrated Flood Insurance model

Climate stories



Social vulnerability tool

*Figure 8. Flood Adapt Tool page*

In its final iteration, an additional filter category (“type of tool”) has been added to separate tools themselves from services. Most of the REACHOUT tools are free tools (open source) but in some cases the implementation of the tool in the local context may require some effort, in terms of the time required for understanding the tool or the time require for its application (All soft tools, such as guidelines, NBS catalogues, workshops) and others in terms of time require to gather local and/or EU-level data to contextualize the tool in a new city or code-implementation (All technical tools, such as CRCTool, TAT, Flood Adapt, etc.). So, a new field “cost/effort for implementation” has been added to describe the cost or effort for implementing the tool in another city, so that users can take into account the resources needed for implementation or using that specific tool. Additionally, one dedicated consultancy service is considered as an overarching resource, focused on the framework itself. The Triple-A framework facilitates deeper reflection at the local level and can shape adaptation efforts and processes.

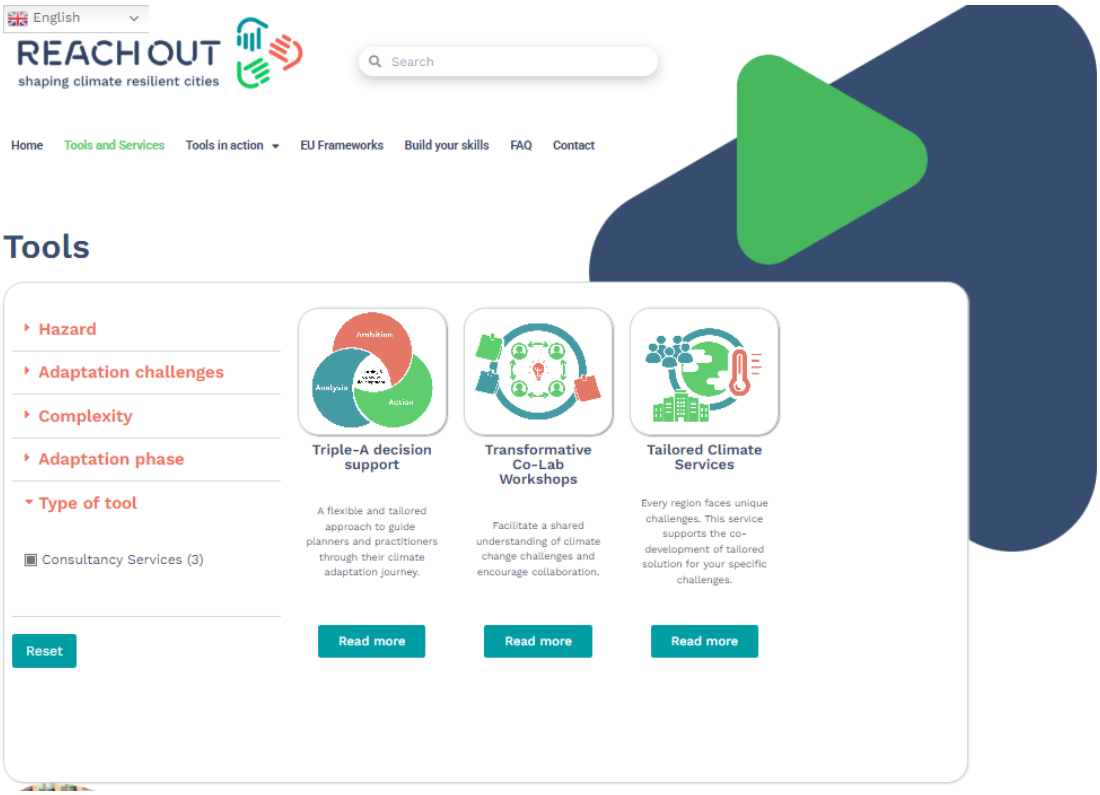



*Figure 9. REACHOUT services available in the Triple-A toolkit*

Consultancy services are available to support the effective implementation of the tools, ensuring they are tailored to specific contexts. These services provide expert guidance, technical assistance, and strategic advice to maximize their impact. By clicking on one of these services a full explanation is provided.

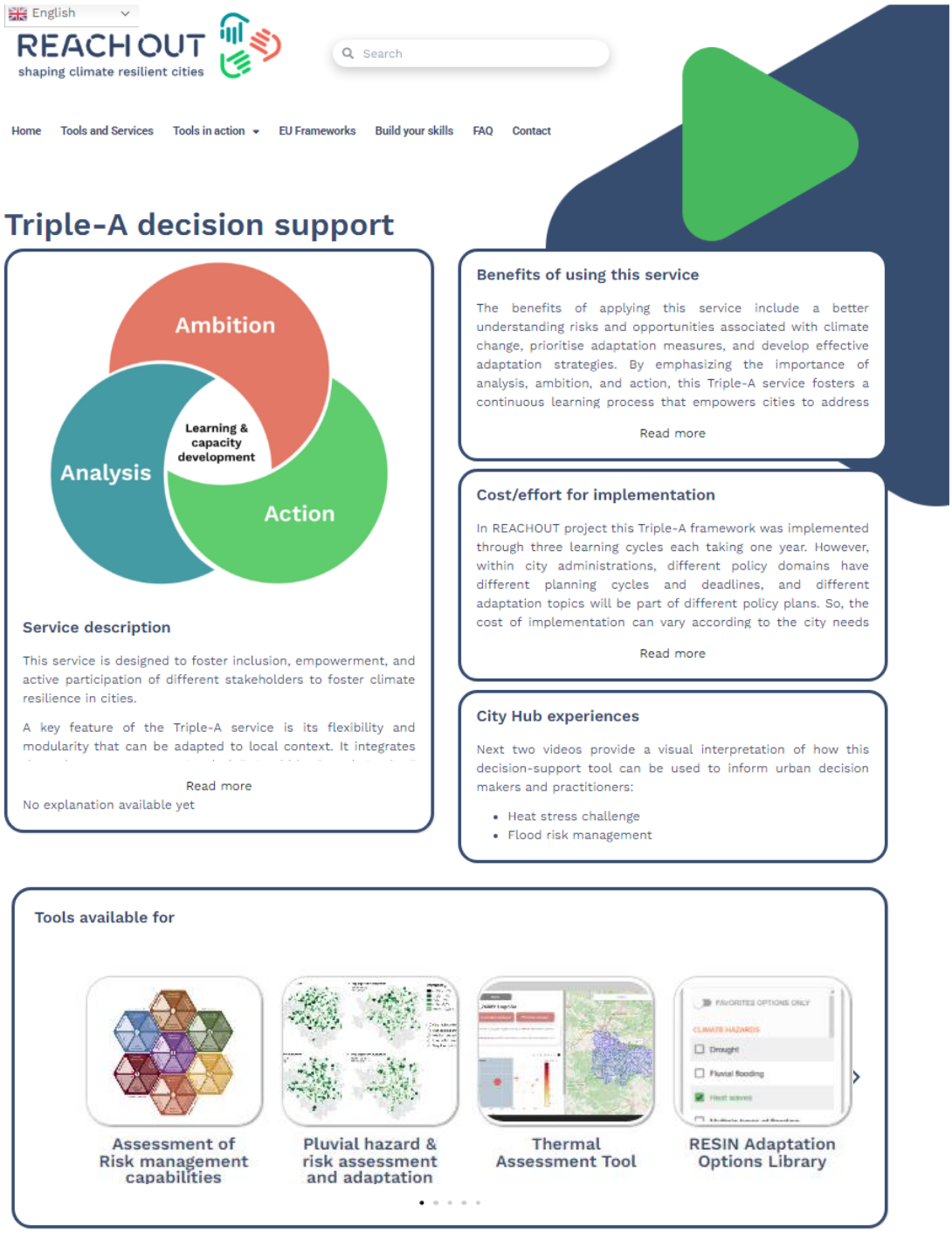



*Figure 10. Triple-A decision support – for climate adaptation*

## 3.1.3 Tools in Action

This module aims to demonstrate how the various tools provided in the Triple-A Toolkit can be applied across different contexts and to address a range of challenges. The section is organized to inspire new users by showcasing the potential applications of these tools, while also offering insights from the REACHOUT Cities' experience in utilizing them.

In its final iteration, an additional category has been added “City Solutions” to showcase how Triple-A framework has been implemented in REACHOUT cities to build resilience thought the

section of different REACHOUT tools applicable for analysis, ambition or action phases. The previous category “Urban Challenges” has been integrated into this new category.

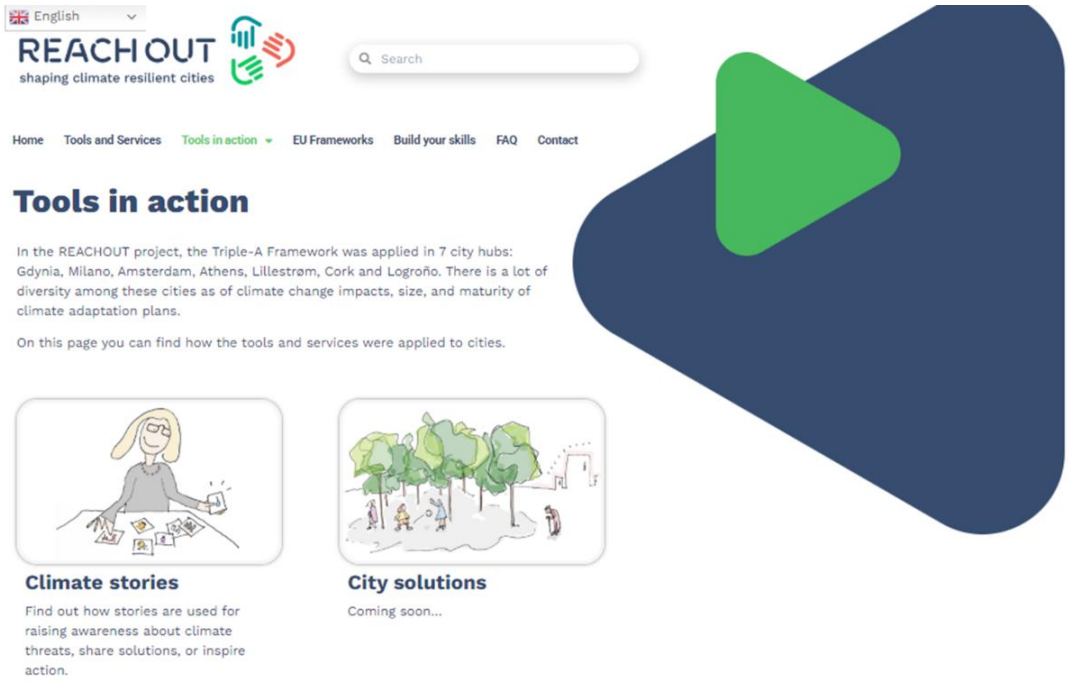



*Figure 11. Tools in action page*

The Climate stories section is intended to highlight how the REACHOUT project uses climate stories to bridge the gap between science and society. These climate stories combine structured narratives and visualizations to effectively communicate scientific knowledge. By integrating the scientific outcomes of the REACHOUT project with the specific needs of cities, these stories use storytelling as an innovative communication method. The section invites users to explore various climate stories, showcasing how this approach helps cities understand and address climate challenges.


*Figure 12. Climate Stories main page*

By clicking in each city in the map, a pop-menu appears with the overview of the climate story and the link to access it in local and English languages.

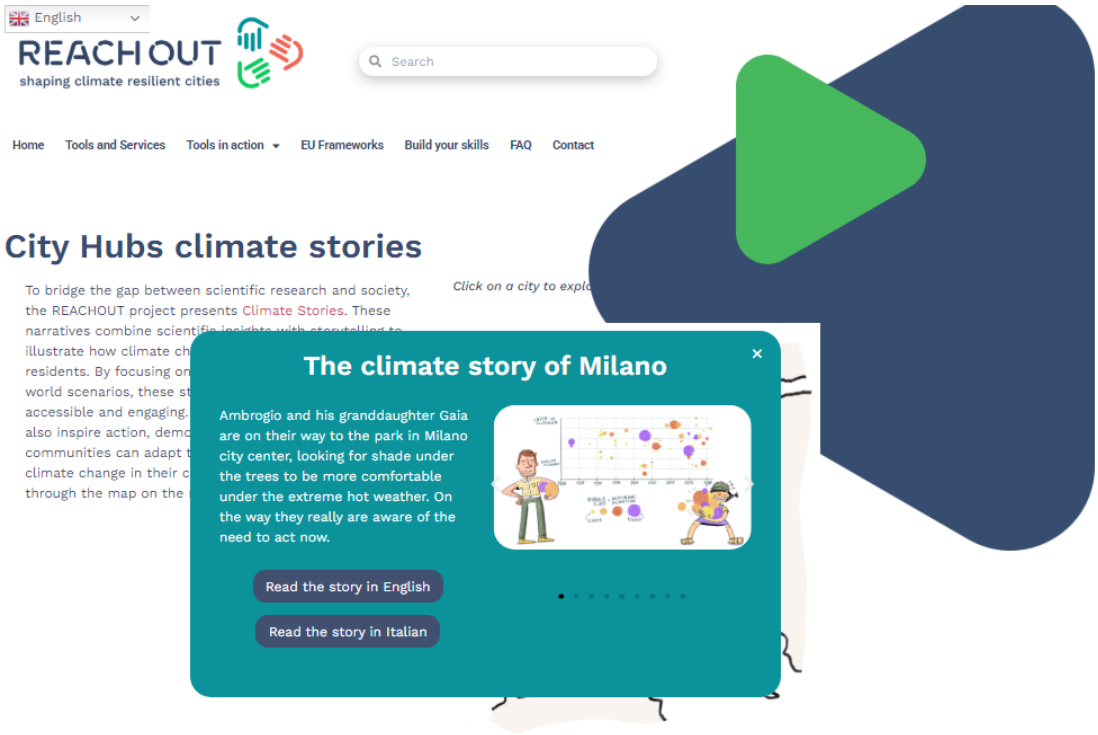



*Figure 13. Example of the pop-up menu for the Milano climate story.*

The six climate stories are summarized in the next table with the link in English to access them.

*Table 1. REACHOUT climate stories*

| City-hub | Overview | Access link |
|---|---|---|
| Logroño | Javier and Maria, two students, learn at school about the growing frequency and intensity of heatwaves in Europe, which also affect Logroño. Their story highlights the different ways to better adapt to climate change and its impact on the city. | Javier and María |
| Milano | Ambrogio and his granddaughter Gaia are on their way to the park in Milano city center, looking for some shade under the park trees to be more comfortable under the extreme hot weather they are suffering. On the way they really are aware of the need to act now' | Ambrogio & Gaia |
| Gdynia | During an extreme rainfall event, Jan watches in fear as water rises dangerously close to flooding his apartment. His experience highlights the urgent need for climate adaptation in Gdynia, inspiring the community to take action and build a more resilient future together. | Gdynia's Climate Story |
| Lilestrom | Different generations face challenges from increased extreme rainfall due to climate change, despite existing protective measures. The city implements new measures to mitigate flooding and enhance resilience, encouraging community involvement to adapt to evolving climate conditions. | Resilient Lillestrøm |
| Cork | In "Living with Water," Gráinne meets her grandson Sean, his wife Miriam, and their son Fionn on a sunny June afternoon. They gather at their favourite bench, reflecting on how their community has adapted to living harmoniously with water. | Living with water |
| Athens | Grandmother Sophia struggles with heatwaves affecting daily life, especially when going outside with her grandkids. Her story highlights the city's response, including appointing Europe's first Chief Heat Officer, urban greening, and community initiatives. The narrative encourages citizens like Sophia to take action in building a cooler, more resilient Athens by 2030. | A Cooler Dawn for Athens in 2030 |

The section on demonstrators within the toolkit aims to showcase the value and impact of Triple-A climate services and tools in addressing climate-related challenges, particularly flooding and heatwaves. It highlights how tools developed through the REACHOUT project can assist cities in tackling these issues. By presenting practical examples of tool usage, the demonstrators demonstrate their potential benefits for other urban areas facing similar climate risks. The six key demonstrators, named **city solutions**, are:

1. "**Expanding despite the floods**" – lessons from Cork on managing flooding in rapidly growing urban areas.
2. "**Beating the heat in metropolitan areas**" – lessons from Milan and Athens on addressing heat challenges in large cities.
3. **"Partnering with nature to thrive"-** How to plan for NbS with lessons from Milan, Athens, Logroño, Gdynia, and Lillestrøm

4. "**Putting climate adaptation on everyone's agenda**" – insights from Logroño, Gdynia, and Lillestrøm on where to begin with climate adaptation.
5. **"Bringing everyone on board"** – How to plan climate adaptation among other urban developments with insights from Cork and Logroño.
6. **"Protecting People and Investments with Open Data"-** Insights from co-developing services with real estate investors lead by APG in Amsterdam.

### 3.1.4 EU Framework

The EU Framework module serves as a gateway to understanding and leveraging key European Union initiatives, policies, and resources related to climate adaptation and resilience. EU Mission on Adaptation unites European regions in their pathway to resilience by implementation of transformational adaptation and emergency management strategies. This is supported by the European Environment Agency, who has developed the Regional Adaptation Support Tool (RAST) that provides practical guidance to planning, implementation and evaluation of climate adaptation strategies. This tool is based on the Urban Adaptation Support Tool.

The Triple-A framework is a versatile approach that can also be aligned with the Urban Adaptation Support Tool (UAST) to support formalized adaptation plans. So, this section provides a clear guidance on how REACHOUT tools can support this process by exploring each step and provide practical understanding of tools can be used.

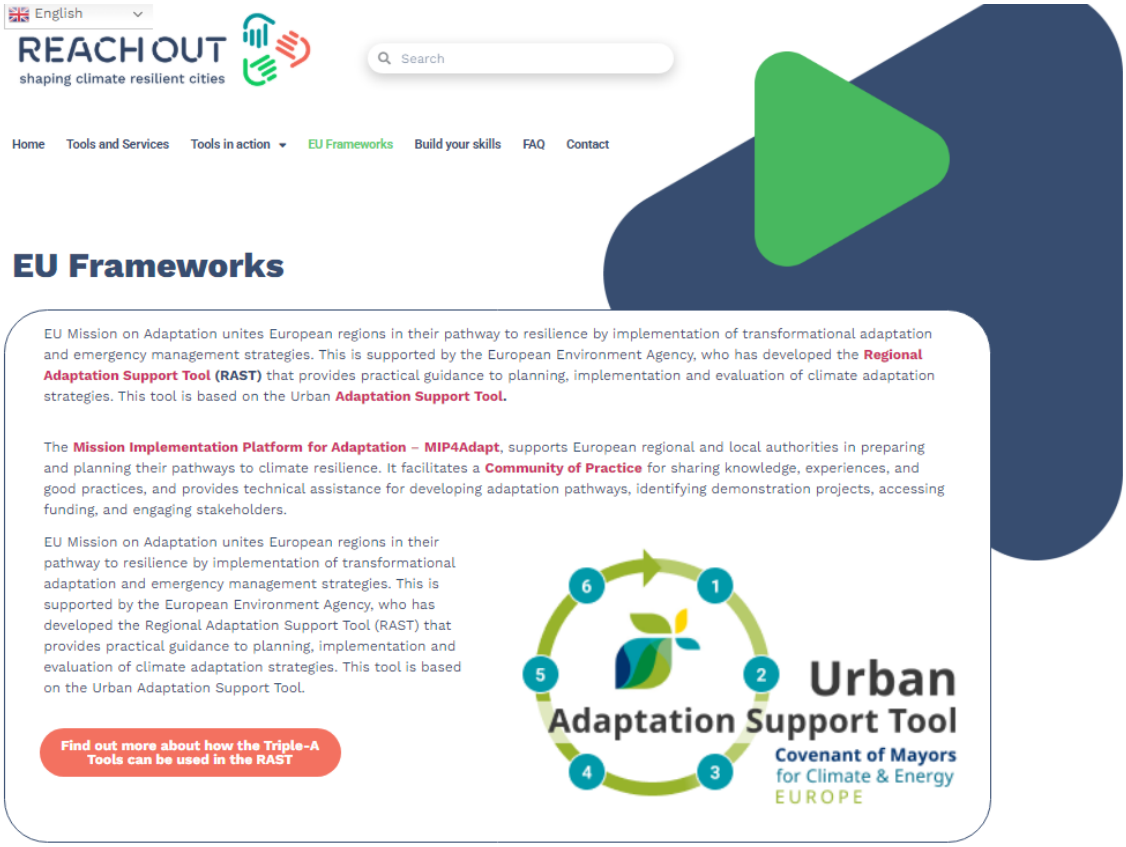



*Figure 14. EU Framework*

The user can find out more information on each UAST step as well as on the best REACHOUT tools supporting the selected step (See example in Figure 15).

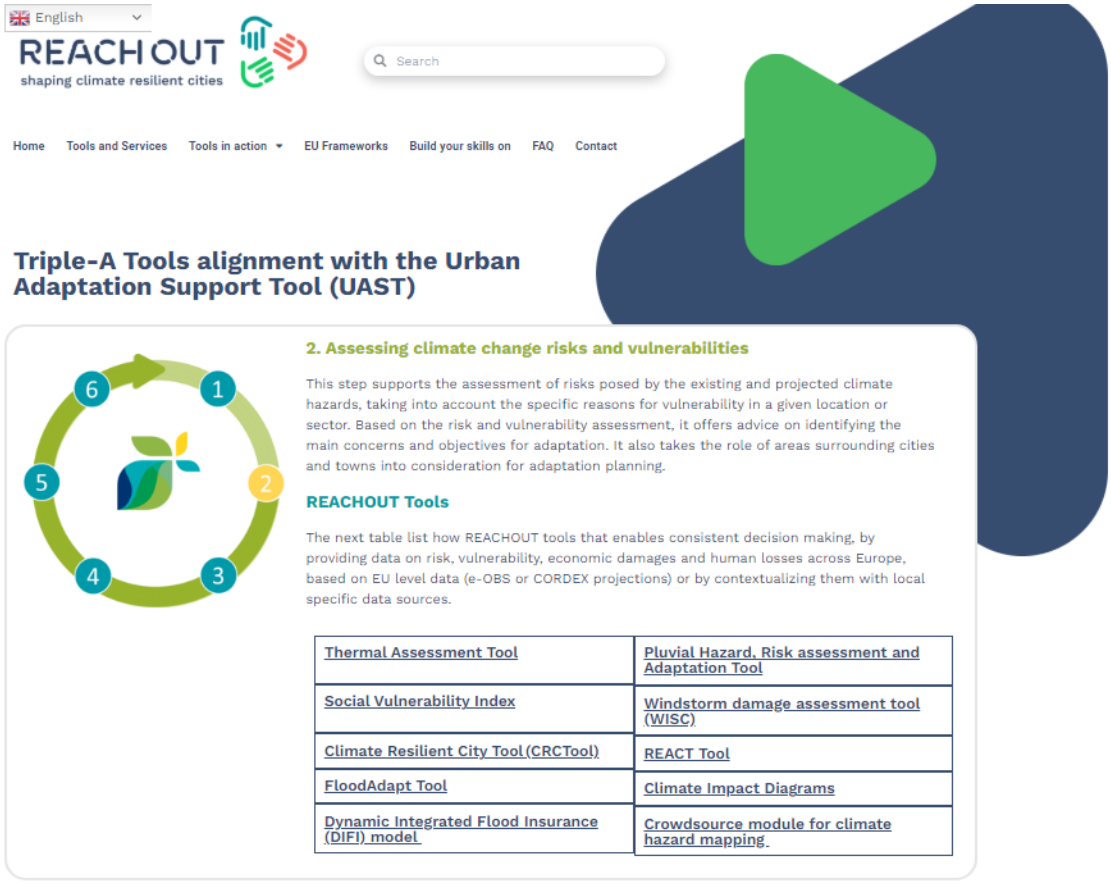



*Figure 15. REACHOUT tools supporting the UAST-step 2*

## 3.1.5 Build your skills

The *Build Your Skills* module is designed to empower users by enhancing their knowledge and capabilities in climate adaptation and resilience. It provides six training materials in the form of webinars where practical guides are provided for various user groups such as city planners, policymakers and practitioners.

Key topics covered include climate risk assessment, resilience planning, governance strategies, stakeholder engagement and effective communication using for example climate stories. These six training resources offer various hands-on tools and guidance that equips users with the practical skills needed to apply the Triple-A Framework and Toolkit effectively in their local contexts.

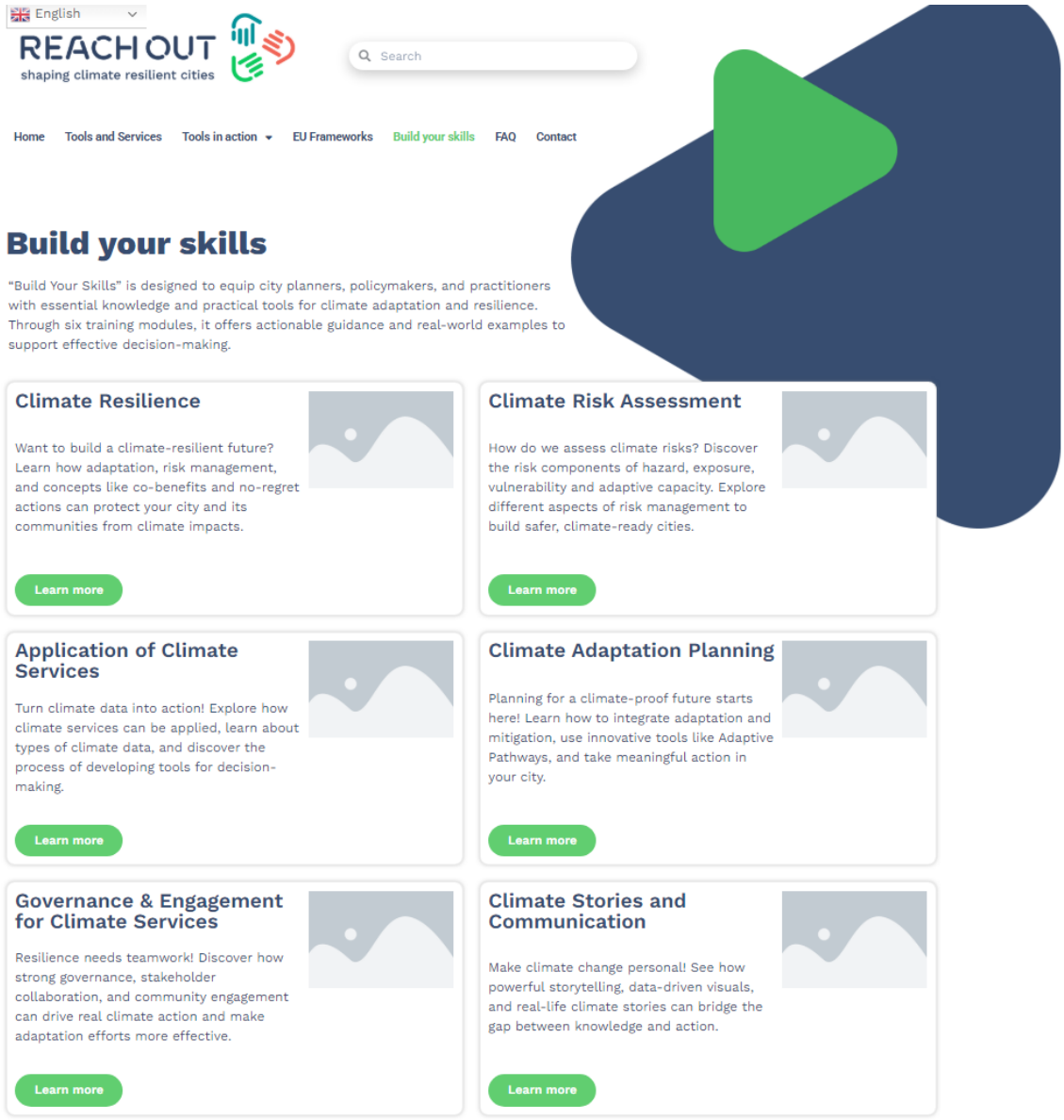



*Figure 16. Learning modules - main page*

The user can select any of the above learning modules, for example the one focused on climate services and applications at the city level. Each module is structured in 3 or 4 smaller sections, called "microlearning", for example:

1. **Climate services and climate information sources:** introduction about climate services; climate indicators; observation/climate models/re-analysis; timescales; C3S
2. **Climate services development process:** development phases of climate services, including reference to REACHOUT co-creation process
3. **Application of climate services in cities:** practical examples of application of climate services in cities (so far it only presents some of REACHOU tools).

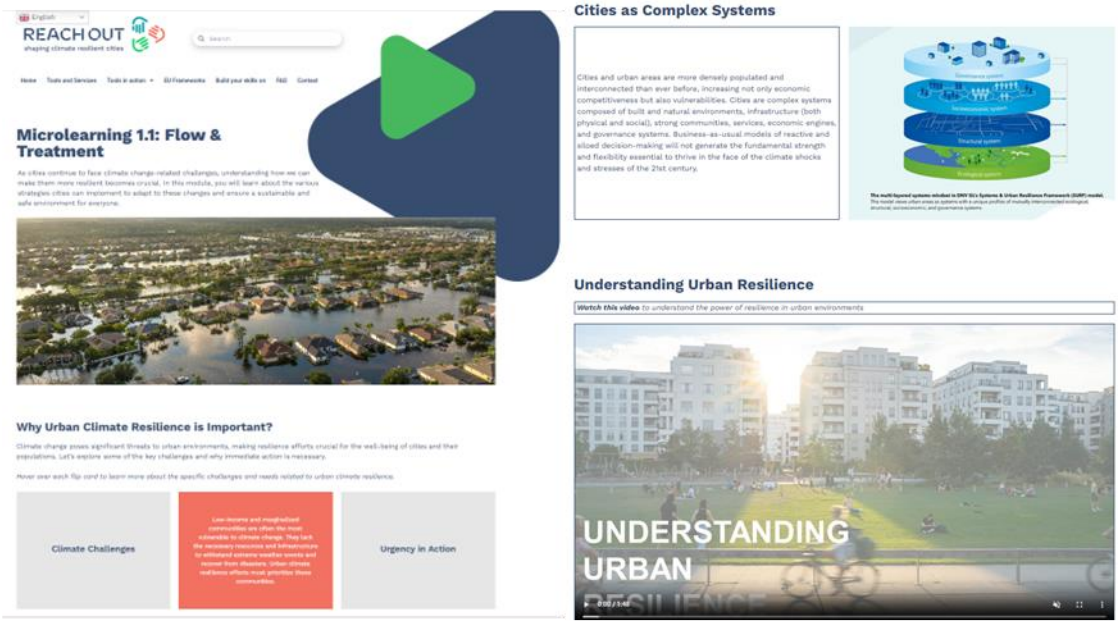



*Figure 17. Example of the interactive microlearning content of the Learning Module 1. Climate Resilient*

### 3.1.6 FAQ

This module aims to make the toolkit more accessible to the users by providing guidance on frequently asked questions that have emerged from interactions with REACHOUT cities. The given questions directly relate to identified needs and solutions, presented in a clear and concise manner. This section serves as an easy entry point to the toolkit, helping users quickly understand its full potential for cities.

Additionally, the module includes an open form where users can engage with the REACHOUT consortium by submitting their own questions or comments. This feature fosters direct communication, enabling users to seek clarification, provide feedback or access tailored support and the marketplace offer of tools and services. By promoting dialogue, this section ensures the toolkit remains user-focused and responsive to evolving needs.

See **Annex II** with the final list of frequently asked question.

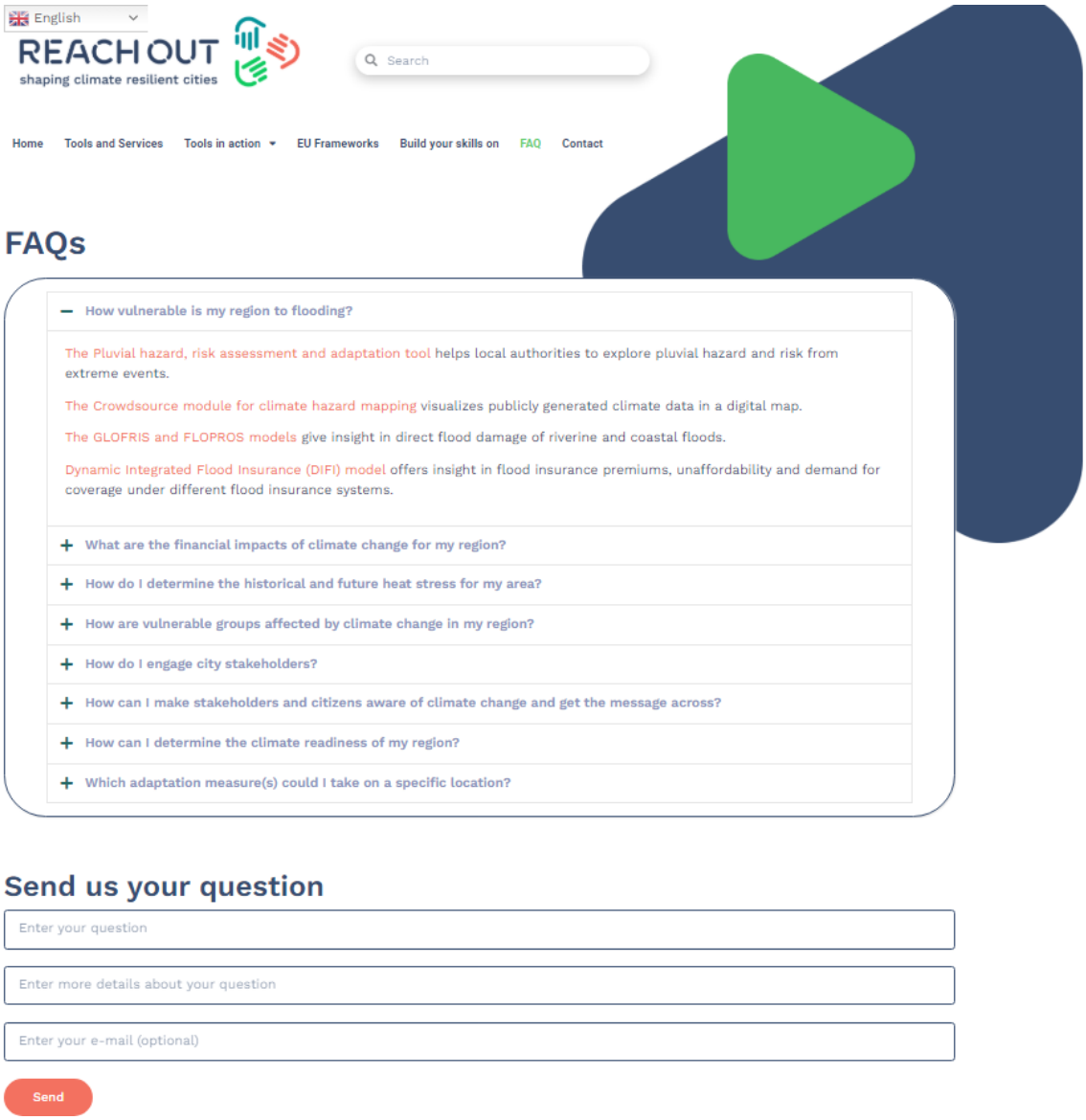



*Figure 18. FAQs page with functionality to add new question/comment*

## 3.2 Development process evolution

The Triple-A toolkit has evolved significantly over the course of the REACHOUT project as a result of the interactions with REACHOUT municipalities and the iterative conversations among the REACHOUT research partners. This section particularly focuses on the inputs, objectives and scope, structure and learnings of the toolkit development process per cycle.

Overall, the toolkit's structure has shifted from being a basic resource repository to a comprehensive, user-friendly platform that supports not only tool access but also capacity building, networking, and the integration of climate adaptation into broader policy and governance frameworks.

### Cycle 1: The REACHOUT Triple-A Toolkit Launch

- **Inputs**: At this early stage, the focus was on developing a flexible and modular platform that could be tailored to local users. The toolkit combined stand-alone tools, visualizations, and services to help users understand climate impacts. The key input

was the design of tools and services aimed at accelerating climate change adaptation through transformative solutions.

- **Key Objective**: The primary objective was to offer tailored solutions to enhance climate resilience by building capacity, supporting resilient development plans, and providing access to stand-alone tools and climate services. The toolkit aimed to inspire users through narratives and examples of adaptation applications in other cities.
- **Scope**: The focus was on providing foundational resources and accelerating adaptation by offering a variety of tools and services to meet policy process needs.
- **Structure**: The toolkit's structure was simple, focusing on five core components: an overview of tools, guiding questions to navigate users to appropriate tools, a strategic planner for resilience plan development, climate stories showcasing REACHOUT city examples, and a learning section with modules and guidance.
- **Learnings**: The toolkit aimed to meet the diverse needs of different cities and users by ensuring it was adaptable and could support a wide range of adaptation efforts. It recognized the need for a platform that could foster both practical applications (through tools) and inspiration (through examples). It also highlighted the importance of promoting resilience planning through a marketing platform.

**Cycle 2: Focus on City Perspectives**

- **Inputs**: The toolkit's input evolved to include city-specific hubs (e.g., Amsterdam, Athens, Milan) that tested and applied the tools in real-world contexts. This allowed for more tailored resources and fit-for-purpose visualizations. The development of climate stories became an essential input to share experiences and best practices across cities. These inputs and reflections also shaped the toolkit itself.
- **Key Objective**: The objective shifted towards supporting cities through the full adaptation cycle (Analysis, Ambition, Action). It aimed to activate city hubs for testing and applying tools, allowing urban planners to assess climate risks, prioritize adaptation measures, and implement strategies. Additionally, capacity-building and awareness-raising became central to increasing cities' ability to use the toolkit effectively.
- **Scope**: The toolkit began focusing more on urban-specific needs, building an ecosystem that integrates climate services into local decision-making processes and providing a platform for sharing knowledge across cities.
- **Structure**: The structure refined the components for greater user flexibility, allowing users to browse tools freely or seek guidance through questions. It introduced a stronger focus on urban policy narratives and mainstreaming climate adaptation, particularly in the Strategic Planner section. Climate stories continued to highlight the cities' experiences, while the learning module was conceptualised to include tutorials
- **Learnings**: The toolkit learned from the specific needs of different cities and incorporated user feedback. It highlighted the importance of supporting all components of the adaptation cycle (Analysis, Ambition, Action) and emphasized the role of ambition-setting to develop effective adaptation strategies. The project also began analysing how to sustain the toolkit beyond the life of the project by considering business models and market strategies.

**Cycle 3: Sustainability of the toolkit**

- **Inputs**: The last improvement cycle saw the toolkit's inputs being refined into a catalogue of resources that provide technical tools supporting climate services, complementary soft tools to enhance the use of these tools and integration of their outputs in policy and services to deploy soft tools, to co-create tools supporting climate services and/or to implement the Triple-A framework. It also integrated insights from

the seven city hubs into the framework. The toolkit became more structured around the three-pillars of adaptation (Analysis, Ambition, Action).

- **Key Objective:** The primary objective expanded to ensure the sustainability of the toolkit beyond the project lifecycle. This phase aimed to create a long-term legacy through business models, market strategies, and a marketplace for climate services. The toolkit aimed to integrate with broader frameworks to embed climate knowledge into urban decision-making and ensure lasting impact.
- **Scope:** The toolkit's scope now included a stronger focus on providing practical, reusable tools and knowledge, enhancing cities' abilities to implement concrete adaptation policies. It also sought to expand its reach beyond the pilot cities to other urban areas, fostering wider adoption of climate resilience strategies.
- **Structure**: The toolkit's structure evolved further by emphasizing urban resilience and how to integrate climate resilience into urban planning and policy. The toolkit aligned itself with **EU framework(s)**, offering channels for networking through the existing structures. **Building Skills** became a dedicated module for training across several themes. Finally, the **FAQ-Forum** introduced an interactive section for user support, featuring guiding questions. This version is the most comprehensive, reformulating the five distinct modules (See section 3). The different resources, **Tool and services,** have been described considering the cost/effort for implementation and their alignment with the Triple-A framework. **Tools in Action**, highlights tools implementation from different perspectives: city hubs thematic demonstrators, **City Solutions**, and climate stories focus on communication and engagement.
- **Learnings**: A key learning from cycle 3 was the importance of integrating the toolkit into decision-making processes and ensuring it had a lasting impact. The project recognized the need for ongoing engagement and the creation of business models that would ensure the sustainability and commercial viability of the toolkit beyond the project's duration. Furthermore, the feedback from city hubs showed that cities needed tailored tools and resources to address specific urban challenges, reinforcing the importance of context-specific adaptation strategies.

**Summary of the process:**

- **Inputs**: Transitioned from modular tools and stand-alone tools supporting climate services to a more structured catalogue that includes narratives, guiding questions, training and complementary methodologies to better embed climate services in local policies.
- **Key objective**: The key objective in the development of the Triple-A toolkit evolves from providing flexible, modular resources to accelerate transformative climate adaptation in the first cycle of the toolkit development, to supporting comprehensive urban resilience by engaging city hubs and covering all spheres of the adaptation (Analysis, Ambition, Action) in the second cycle. In the third cycle of development, the objective shifts towards ensuring the long-term sustainability of the toolkit through business models and market strategies, while also embedding climate knowledge into urban decision-making and fostering widespread adoption of effective adaptation strategies across cities. This evolution reflects a growing focus on real-world application, local engagement, and lasting impact.
- **Learnings**: The toolkit's evolution emphasized the importance of co-developing resources with cities, integrating the tools into local decision-making, and ensuring long-term engagement through sustainable business strategies. It also learned that capacity-building and knowledge-sharing were key to supporting climate services and urban adaptation efforts.

This progression reflects an increasing sophistication in both the toolkit's design and its ability to meet the diverse, evolving needs of cities facing climate challenges.

# 4 Triple-A Tools and Services.

## 4.1 Introduction of the tools and services

The Triple-A toolkit is compiled from a concrete set of proven successful tools, that have been tested, co-created and validated though the REACHOUT city-hub and are classified according to the Triple-A framework. This allows the users to explore tools that may enable them the deployment of the different components of the Triple-A framework: *Analysis, Ambition* and *Action*. To assist users in identifying of a tool that best meets their city's needs various categorization fields have been assigned to each tool, enabling the creation of filters or tags. Some of these filters are:

- **Hazard**: It refers to the to specific climate-related phenomena/s that a tool or service that can focus on identifying, analysing, monitoring or managing risks or vulnerabilities associated with that climate-related hazard. In REACHOUT this category ranges from fluvial flooding, coastal flooding, pluvial flooding, heat stress, windstorms or sea level rise.
- **Adaptation Challenge:** It refers to the process of addressing and overcoming the difficulties associated with adjusting to the inevitable impacts of climate change cities face. It includes identifying and reducing climate-related risks and vulnerabilities, raising awareness and building capacity, setting adaptation goals and objectives, and implementing effective measures to cope with the changing climate.
- **Complexity:** It refers to the degree of difficulty in understanding, using, and interpreting a climate tool or service. It includes the technical knowledge required, the complexity of data and input handling, the sophistication of the output, the level of customization and integration, and the cognitive effort needed to make sense of the tool's results for decision-making. A tool with high complexity may be suited to experts but could be challenging for non-expert users, while simpler tools may offer more user-friendly but less detailed outputs.

In addition to the categorization fields related to climate change adaptation, several key elements shape the Triple-A toolkit into a dynamic and structured marketplace, enhancing usability and accessibility for diverse stakeholders. These elements include:

- **Tool Access Model**: This refers to the software licensing model, which determines how users can access the tools. In REACHOUT, two types of access models are defined: "Free tools," which are openly accessible, and "Licensed/Commercial tools," which require a subscription or purchase".
- **Type of Tool:** This classification defines the nature of the tool. In REACHOUT tools fall into two main categories: (1) "technical or data-driven tools" refer to software, models, or systems that generate, process, and provide data and information of various types. These tools support users in analysing, visualizing, or simulating complex processes and may require customization or pre-processing of diverse data sources for effective application and (2) "soft tools" which include guidance documents, tutorials and structured methodologies for workshops. These tools support the development of adaptation strategies, enhance stakeholder awareness, and build capacity.

Next Table 2 provides an overview of all data-driven and workshop-driven tools, including their typology based on the previously defined categories. The categorization aligns with city-hub

requirements, ensuring that each tool is effectively mapped to relevant adaptation challenges, hazards, and service models. Additionally, the table highlights key attributes such as the tool's access model, complexity level, and type (technical or soft tool), providing insights into the level of expertise and resources required for implementation. This overview enables to understand the full potential of the Triple-A toolkit to support adaptation planning processes.

*Table 2. Triple-A Tools categorization based on city-hubs needs. (See report D3.7 with a detail description of each tool)*

| Tool name | Hazard | Adaptation Challenge | Tool Access Model | Type of Tool | Complexity |
|---|---|---|---|---|---|
| **Pluvial hazard, risk assessment and adaptation** | Pluvial Flooding | (2) Risks and Vulnerability; (3) Adaptation measures | Licensed Tool | Technical/data-driven Tool | Medium |
| **Assessment of Risk management capabilities** | No hazard specific | (1) Awareness and Capacity Building | Free Tool | Technical/data-driven Tool | Low |
| **Climate Resilient City Tool (CRCTool)** | Floods and Heat | (1) Awareness and Capacity Building; (3) Adaptation measures; | Free Tool | Technical/data-driven Tool | Medium |
| **FloodAdapt Tool** | Pluvial, Fluvial and Coastal Flooding | (1) Awareness and Capacity Building; (2) Risks and Vulnerability; (3) Adaptation measures | Free tool | Technical/data-driven Tool | Medium |
| **Social Vulnerability Tool** | No hazard specific | (2) Risks and Vulnerability; | Free tool | Technical/data-driven Tool | Low-Medium |
| **Thermal Assessment Tool** | Heat Stress | (2) Risks and Vulnerability; | Licenced tool | Technical/data-driven Tool | Low |
| **Adaptation pathway generator tool** | No hazard specific | (3) Adaptation measures | Free tool | Technical/data-driven Tool | Low |
| **Dynamic Integrated Flood Insurance (DIFI) model** | Fluvial Flooding | (2) Risks and Vulnerability; | Free tool | Technical/data-driven Tool | Medium |
| **FLOPROS model and REACT tool** | Fluvial, Coastal Flooding | (2) Risks and Vulnerability; | Free tool | Technical/data-driven Tool | High |
| **Crowdsource module for climate** | No hazard specific | (2) Risks and Vulnerability; | Licenced tool | Technical/data-driven Tool | Medium |

| | | | | | |
|---|---|---|---|---|---|
| **hazard mapping** | | | | | |
| **Climate impact diagrams** | No hazard specific | (2) Risks and Vulnerability; | Free tool | Soft Tool | Low |
| **Climate stories** | No hazard specific | (1) Awareness and Capacity Building | Free tool | Soft Tool | Low |
| **Windstorm damage assessment tool (WISC)** | Windstorms | (2) Risks and Vulnerability; | Free tool | Technical/data -driven Tool | Low |
| **RESIN AOL (Adaptation Options Library)** | No hazard specific | (1) Awareness and Capacity Building; (3) Adaptation measures; | Free tool | Technical/data -driven Tool | Low |
| **Climate Resilient Development Pathways (CRDPs)** | No hazard specific | (1) Awareness and Capacity Building; (3) Adaptation measures; (4) Vision and objective setting; | Free tool | Soft Tool | Medium |
| **ARCH Resilience Pathway Visualization Tool (ARCH RPVT)** | No hazard specific | (1) Awareness and Capacity Building; (3) Adaptation measures; | Free tool | Technical/data -driven Tool | High |
| **Theory of change (ToC): Navigating transformation towards a desired vision** | No hazard specific | (1) Awareness and Capacity Building; (4) Vision and objective setting; | Free tool | Soft Tool | Medium |
| **Adaptation pyramid** | No hazard specific | (4) Vision and objective setting; | Free tool | Soft Tool | Low |
| **NBS measures** | No hazard specific | (3) Adaptation measures | Free tool | Soft Tool | Low |
| **NBS Adaptation Tool** | No hazard specific | (1) Awareness and Capacity Building; (3) Adaptation measures | Free tool | Soft Tool | Low |

## 4.2 Consultancy services

This defines the range of advanced services that can be offered by combining technical tools (e.g. Risk assessment) with softer methods (e.g., storytelling) to demonstrate how climate services can be better embedded in city contexts. In REACHOUT, services fall into three main categories: (1) Triple-A decision support for climate adaptation, (2) co-creation of tailored climate services and (3) climate adaptation workshops.

REACHOUT project has focused in fostering appropriate engagement and implementing robust co-creation processes in the city-hubs to collaboratively develop user-driven climate services and tools, helping bridge the gap between the supply and demand for climate services.

The above tools co-creation process (see section 4.3 Co-creation process of tools) has required ideation and co-production through several iteration cycles following the Triple-A approach (analysis-ambition-action). Along these iteration cycles, the involvement of REACHOUT partners to enhance co-creation and workshops facilitation has been fundamental to integrate outcomes. These services have proven to be a pivotal mechanism for contextualizing the Triple-A approach and promotes inclusivity, ownership, and commitment among stakeholders, as well as for improving communication with local stakeholders and facilitating the integration of outputs into adaptation planning.

As a result, these advance services, have been recognized as pivotal components and have been incorporated into the resources provided by the Triple-A toolkit to further strengthen their impact. The following three services have been designed to encourage collaboration, enhance understanding of climate risks and opportunities, and ensure that the tools are used for climate action and support transformative changes:

1. **Triple-A decision support for climate adaptation**
   This premium decision support service offers a flexible and tailored approach to help urban planners and climate adaptation practitioners to start their climate adaptation journey. It integrates three key components: “Analysis,” “Ambition,” and “Action.” through a process of continuous learning, cities assess climate impacts and risks, establish clear objectives and goals, and develop and implement effective adaptation strategies. By fostering stakeholder collaboration and leveraging robust tools and expert guidance, the Triple-A decision support serves as a dynamic and adaptable guide for cities as they navigate the complexities of urban adaptation. This service enhances value by offering expert advice and guidance, ensuring that cities and regions seamlessly implement the Triple-A framework while benefiting from practical tips and best practices drawn from past experiences.

2. **Co-creation of tailored climate services**
   Each region and community are unique in their context characteristics as well as the climate challenges they face. This is why tailored climate services are needed. So, this consultancy service supports the collaborative process where tool developers and end-users actively work together to address common challenges to ensure that the tools and solutions developed are not only relevant but also tailored for the specific contexts in which they will be implemented. By aligning the climate services to local needs, REACHOUT empowers users to take decisive action and build long-term resilience against the changing climate.

3. **Climate adaptation workshops**
   At the intersection of expertise and stakeholder input, the climate adaptation workshops bring together professionals, researchers, and community representatives to co-create climate strategies. These workshops facilitate, potentially supported by

some of the simple and soft tools of the toolkit, a shared understanding of the challenges presented by climate change and encourage the collaborative design of innovative solutions.

By offering expert advice tailored to the local context and providing structured facilitation, this consultancy service ensures that discussions are both strategic and actionable. Participants gain valuable insights, access best practices, and develop solutions grounded in real-world experiences. The workshops are designed to shift perspectives and enhance decision-making, empowering cities and regions to implement effective, locally relevant adaptation strategies with confidence.

These consultancy services, complementary to the Learning Program, are an essential Triple-A toolkit component, to carry on the support being done by city liaisons and knowledge brokers, offering a tailored and knowledge-informed service to ensure cities receive the expertise needed to co-create tailored climate service or navigate thought the tools to solve complex climate challenges cities face.

They contribute to the foundation of REACHOUT's mission to provide impactful, user-centered climate solutions that are built on collaboration, expert insights, and a deep understanding of local contexts.

## 4.3 Co-creation process of tools

This section focusses on a better understanding of the co-creation process (One of the consultancy services) implemented in REACHOUT. This process (Figure 19) supports both stakeholders' engagement - essential for raising awareness and fostering ownership- and the tools' design process, which is informed by and contributes to the engagement process. Both processes run in parallel, with continuous interactions though several co-productions cycles.

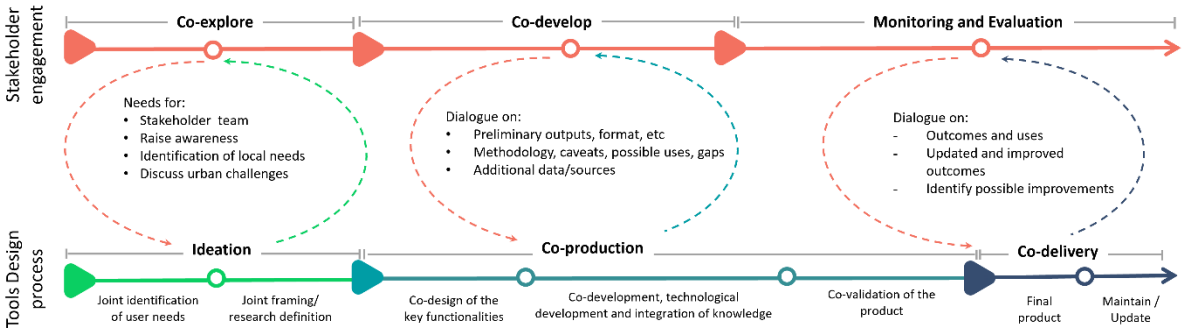
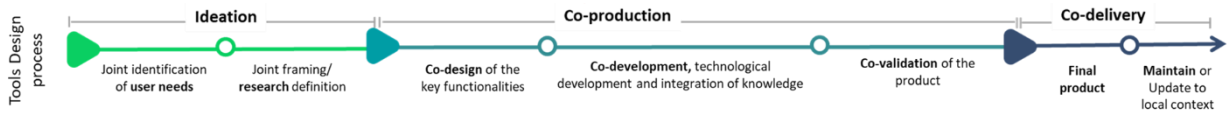



*Figure 19. REACHOUT Co-creation process*

The co-creation process within REACHOUT can be located on a spectrum from developing new services and tools from scratch to tailoring existing services and tools to the cities' contexts. Three main categories have been identified:

1. Fully co-created tools (e.g., the Thermal Assessment Tool, Climate Stories).
2. Existing tools were further improved as part of the co-development process to comply with local needs (e.g., FloodAdapt Tool, Pluvial Flood Tool, Social Vulnerability Index).
3. Established tools were predominantly contextualized and adapted to the local setting (e.g., Climate Resilient City Toolbox).




| Example combination of Tools design stages | Example of REACHOUT Tool | Explanation | EU level data considerations |
|---|---|---|---|
| | Thermal Assessment Tool – Heatwaves Service | This tool was fully co-designed, co-developed and co-validated during the project to develop a tailored final product to fulfil context-specific user needs. | The tool uses EU public, independent and authoritative data from Copernicus Climate Change Service (C3S). It does not require local data. |
| | Climate Stories | This tool requires a bif effort on co-desing and co-validation while research and technological development is less demanding. | Local and context specific data was used. |
| | Thermal Assessment Tool – Heatmap Service | This tool were fully co-designed and co-developed, considering user needs but it requires less effort from the user perspective on validation | For HeatMaps (surface urban heat island (SUHI)) the tool requires contextualization for each case by using remote sensing |
| | FloodAdapt<br>Pluvial Flood Tool<br>SVI-index | These tools were further improved as part of the co-development process to comply with local needs and updated with local data. | Local Census data is required to calculate the SVI Index. Precipitation inputs used for FloodAdapt/PluvialTool |
| | Climate Resilient City Toolbox | These matured tools were predominantly contextualized and adapted to the local setting. So, co-design was no needed. | In the future, the tool might benefit from EU datasets on landuse and subsoil characteristics. |

*Figure 20. Example of combination of tools design stages, description, and data considerations*

Although hybrid categories may also emerge, Figure 20 Figure 20presents how the combination of stages takes place along each tool design process. The design effort has varied based on the tool's stage (whether it is in the conceptual phase or already developed), user requirements for existing tools, and the nature of the tool. For already developed tools, updates and upgrades to local contexts involve a second co-creation phase, which typically includes both ideation and some form of co-production.

## 4.4 Individual tools' innovation and research outcomes

During the project, each year the tools have been iteratively improved (co-developed) and based on the experiences from the previous iteration cycle, a more in-depth analysis of the key requirements per tool and per city has been gathered (See report D2.4 – Requirements for Toolkit development) gathering requirements considered for the 3rd iteration cycle. Now, that the three iteration cycles have been successfully completed, the goal of this subsection is to present tools' research and innovation outcomes achieved. To answer this, four main guiding questions are posed to each tool developer to gain insights into further evolution of the tools:

1. What has been the **key research and innovation** of the tool?
2. What have been the tool **key outcomes/impacts:** *What outputs have been generated? How the tools inform decision-making? What has been done (impact) with this output?*
3. *What have been the **research outcomes (key learnings)** along the three iteration cycles within REACHOUT cities?* Identify key learnings and insights from the point of view of **integration, usability, and scalability**?
4. ***Further innovation.** E.g. What new capabilities will need to be added? Which are the further research steps - in order to meet future interesting outcomes*?

For 12 tools that were actively developed and applied in the city hubs during the project, the answers to these questions have been collected in Annex I. Out of these 12 tools, two tools, the thermal assessment tool and the climate resilient development pathways, were fully developed from scratch within the project. Some common research and innovation highlights are:

- **Improved relevance** by integration of the tool in policy practice. Practically this is achieved in different ways. Very directly this is done **by tailoring the tools** to specific needs in the cities and by making future tailoring of the tool easier as well. For example,

for the CRCT tool in Athens a new functionality was added that can distinguish public and private adaptation. This made the tool more relevant to support decision making on responsibility for and financing of implementation of measures. Another example is the new functionality designed for the pluvial flood assessment tool to identify potential areas for greening, that supported Milano in prioritizing greening projects. Such innovations have made the individual tools more relevant for many other cities that deal with similar questions. Indirectly relevance is greatly enhanced by packaging the tools in a triple A service offer that enables the use of **tools in combination supported by expert consultancy**. Examples of the applications of multiple tools in cities are demonstrated under the city solutions in the toolkit marketplace. Combining social vulnerability mapping with heat and flood impacts is the combination of tools that stands out most. Last but not least integrating the output of tools in recognizable, communicative climate stories is another effective way to increase the relevance of tools.

- **Improved usability** of the tool – This has been achieved through the improvements of Graphical User Interfaces, improved visualisations, and the preprocessing of data by experts for further use by city employees. For example, in the Thermal Assessment Tool (TAT) and the Pluvial flood tool complex data from different sources have been processed in order to make powerful visualisations available to city users. For the Thermal Assessment Tool (TAT) the outcomes are on-line an available, so interactive plots and statistics are available, so that user can download and integrate in local plans. For the CRCT and FloodAdapt tools the preparations and tailoring of the tool for the local situation has been standardized combining the use of local, national, and European datasets as input. Once the tools are set up and tailored the city can continue to use them. In additions, guidelines, service packages have been to support the use of the tool. A nice example of a guidance is the guidance made on producing climate stories.
- **Improved scalability** of the tools – A key component here was the connection to EU, national and local data infrastructure, the use of standardized data protocols so data can be exchanged easily and open source or commonly used software. Most of the tools have made progress on this. For example, the climate stories make use of the commonly used ArcGIS package that most organizations already use in house. The Flood Adapt tool is using open-source packages of SFINCS and Delft-Fiat open to use to anyone. Also, the REACT tool is open source and available on Zenodo. As it uses a global data set of flood hazards it can be applied in any region in the world. The Social Vulnerability Index tool is applicable in all areas where census data and environmental data are collected, both in the EU and globally. The Thermal Assessment Tool uses EU level climate data from Copernicus Climate Change Service (C3S), which is public, independent and authoritative and homogeneous data across the EU. So the methodology can easily be scalable to other regions and cities.

Many of the good ideas that came up during the project could not be implemented and are recommended for further innovation. Some examples include:

- For the TAT further improvements on heatwaves definition and risk levels based on additional variables like relative humidity, wind, etc, could be considered in the future.
- For the SVI tool, it would be useful to allow for qualitive data integration for indicators that are not currently mapped quantitively.
- The Flood Adapt could gain further relevance by adding more adaptation options such as insurance policies and coastal Nature-based Solutions, which require the addition of a wave model.
- Adding climate mitigation measures (carbon sequestration) and Improving biodiversity co-benefits KPI's in the Climate Resilient City Toolbox is recommended for future work.
- The REACT took could be expanded to other hazards that can impact real estate beyond just flooding such as windstorms or drought (foundation) risks.

For more information per tool see Annex I.

# 5 Triple-A Learning Modules

The learning modules have been designed to be a cornerstone for cities seeking to build climate resilience and adapt to the pressing challenges posed by climate change. As part of the Triple-A Toolkit, these modules offer cities the knowledge, frameworks, and practical guidance though Triple-A resources to navigate through complex climate risks, enhance adaptive capacity, and build resilience.

The six modules provide a strong foundation based on the Triple-A framework (Analysis, Ambition and Action) by offering in-depth knowledge and practical tools for understanding climate resilience, assessing risks, and planning for adaptation. Each module is tailored to address specific aspects of resilience-building, from foundational concepts like climate risk and resilience, to hands-on approaches for assessing climate vulnerabilities, applying climate services, and planning for both adaptation and mitigation strategies. These learning modules ensure that cities are equipped with the expertise needed to fully leverage the REACHOUT tools and services within the Triple-A Toolkit, enabling them to build a cohesive, adaptive, and sustainable future.

Each module is accompanied by a series of micro-learning lessons, carefully crafted to break down complex concepts into easily digestible, key takeaways, and actionable insights - empowering cities to grasp essential ideas in a concise, interactive and engaging format. These lessons serve as quick, accessible learning, making it easier for city officials, stakeholders, and decision-makers to grasp critical ideas and apply them in real-world scenarios.

## 5.1 Module 1 | Climate Resilience

The module starts introducing the concept of climate resilience and the concept of risk in cities, emphasizing compound effects, the interrelation of shocks and stresses, and the understanding of cities as made of interrelated systems. Climate adaptation is necessary to build climate-resilience in the long-term and improve climate-related risk management and disaster risk reduction. Key definitions of resilience, adaptation, mitigation, and risk (hazard, exposure, vulnerability) are provided.

In addition, the module highlights the concept of co-benefits, resilient dividends and no-regret actions.

**Micro learnings of this module:**

1. Climate resilience, adaptation and mitigation.
2. Climate risk and risk management.
3. Co-benefits of adaptation and resilience.

## 5.2 Module 2 | Climate risks assessment

This module focuses on risk management and specifically on the assessment of climate risk. Climate Risk Assessment (CRA) is the first phase of a decision support framework and to implement actions for risk reduction. Building up on the definition of risk presented in the previous module, it will offer a practical guide on how to run a CRA, showcasing some approaches and examples. In addition, the module presents the capabilities that cities need to

have in place in order to assess and manage risk, including internal capacities, available resources, stakeholder engagement, and others.

**Micro learnings of this module:**

1. Risk management cycle.
2. Climate risk assessment.
3. Risk management capabilities.

## 5.3 Module 3 | Application of climate services

The module provides an overview of climate services, their purpose, key requirements and possible applications. It includes key terminology and types of climate data sources (such as observations, climate models, reanalysis, etc.)

Moreover, it provides a guide for the climate service development process (data acquisition, data processing, outcome delivery), and showcases some applications on platforms such as Copernicus and in REACHOUT cities.

**Micro learnings of this module:**

1. Climate services and climate information sources.
2. Climate services development process.
3. Application of climate services.

## 5.4 Module 4 | Climate Adaptation Planning: guidance on planning for climate adaptation

The module presents different approaches and steps to plan climate adaptation. With reference to MIP4ADPAT, it presents the RAST tools, highlighting the importance of combining adaptation and mitigation and the concept of mainstreaming adaptation. Afterwards, it presents REACHOUT perspective based on Triple-A approach (emphasizing the Ambition phase), and how different tools can be combined and integrated. Examples and application of specific tools are presented, such as the Adaptive Pathways Generator Tool (scenarios, tipping points, adaptation signals).

Lastly, it provides insights on monitoring and evaluating climate adaptation actions.

**Micro learnings of this module:**

1. Planning for climate adaptation.
2. Synergies between mitigation and adaptation.
3. Monitoring climate adaptation.

## 5.5 Module 5 | Governance & Engagement for climate services: institutionalization of resilience and stakeholder engagement

The successful delivery of climate services to local authorities requires solid governance arrangements, partnerships with stakeholders and engagement of end-users. This module presents the main governance components of resilience and risk management, highlighting the importance of institutional collaboration and partnerships with stakeholders. Examples on how to assess governance for climate adaptation and citizens engagement are provided.

**Micro learnings of this module:**

1. Governance for climate service adoption.
2. Stakeholder engagement.
3. Governance and engagement for climate adaptation in practice.

## 5.6 Module 6 | Climate stories and communication

The module focuses on communication of climate risk and action. Besides providing insights on how local authorities can improve the communication around climate change and climate action, the module showcases the climate story as a tool to bridge the gap between climate knowledge supply and climate service demand. Climate stories combine climate change narratives with data visualizations (such as maps, charts, and tables) to get a message across. The module deepens on how REACHOUT climate stories have been developed, how they have been communicated and the level of dissemination they reached within REACHOUT cities.

**Micro learnings of this module:**

1. Climate risk communication.
2. Climate stories to communicate risk.
3. Create your climate story.

# 6 Summary of key learnings and insights

The process of conceptualizing and implementing the Triple-A Toolkit has provided valuable lessons that can guide future adaptation efforts in other cities. This chapter distils the key learnings and insights that emerged from both the development and application of the toolkit, offering a comprehensive view of the challenges, and key successes. In addition, the tools' innovation process has also provided valuable lessons for future developments, emphasizing the need for user-centric design, collaborative co-development, and capacity building. These insights underscore the toolkit's potential to remain a relevant and effective resource for cities as they continue to evolve and adapt to the changing climate landscape.

## 6.1 Lessons learnt

The key lessons learnt on **the toolkit conceptualization and implementation** can be summarized as follows:

**City liaisons and knowledge brokers act as helpful intermediaries between science and city representatives**. Liaisons acted as intermediaries between the technical partners and the city representatives. Knowledge brokers, acting as climate service providers, facilitate connections among tool developers, enabling the exchange of valuable insights. Both have been fundamental in helping cities through their adaptation journey, as they relieved the city partners who were constrained in time, resources or capacity. The city-hub model developed within REACHOUT project ensured mutual understanding, avoiding stakeholder fatigue. Considering this role is key for the use of tools to support decision making. So, this insight has led to the emergence of various consultancy service packages within the Triple-A Toolkit, which can significantly enhance the overall impact of the tools. By providing targeted support, these services help maximize the effectiveness of the toolkit and ensure its successful application in cities, ultimately strengthening decision-making and adaptation efforts.

**Capacity building**: Building the capacity of local stakeholders to understand and use tools ensures long-term success and sustainability, empowering cities to adapt thought evolving tools and technologies. This has shown us the importance of the process and capacity building, both through learning modules and through the provision of consultancy services. These elements are crucial for ensuring that local stakeholders are empowered with the knowledge and skills needed to effectively use the tools and outcomes.

**Flexible solution through integration of evolving tools and approaches**. There is no unique solution applicable for all, so one key element of the Triple-A toolkit is that it is an instrument that requires updates to remain cutting-edge in the fast-evolving adaptation and resilience landscape. This is why a key element of the Triple-A Toolkit is its modularity and adaptability. It is designed to be continuously updated, ensuring it stays relevant and cutting-edge in the rapidly evolving field of adaptation.

**Cross-city learning experiences offer valuable interactions for cities beyond their regional and national boundaries**. The REACHOUT project facilitated exchange moments among city hub representatives through co-creation lounges, learning modules, and workshops. These interactions allow cities to learn from one another and discuss shared challenges, particularly given REACHOUT's European scope. In line with this, the Triple-A Toolkit is designed to facilitate a marketplace where the needs of cities meet the supply of specialized tools/climate services. By enabling seamless connections between users and relevant partners offering expert guidance, technical support, or complementary services, the toolkit acts as an intermediary, simplifying access to these resources while fostering cross-sectoral collaboration and the building of a community of practice.

**Categorisation of resources based on city-specific needs.** Cities around the world are experiencing a growing number of impacts due to climate change. While there is a growing number of tools, services, and frameworks available to support climate resilience efforts, the challenge remains in selecting the most appropriate solutions that align with a city's distinct priorities, capabilities, and local conditions. The Triple-A Toolkit addresses this by offering multiple recognizable entry points for actors in this marketplace. This approach simplifies the screening and selection of relevant tools and services, enabling city planners and decision-makers to easily identify the best options that meet their specific needs and challenges.

**Effective Communication:** City-hubs believe that effective communication is essential for engaging both citizens and municipal departments in climate adaptation efforts. The Triple-A Toolkit supports this by offering resources and guidance on how to communicate complex climate risks and adaptation measures/actions. Sharing real-world climate stories and best practices (city hubs solutions) on how to apply the toolkit's tools has proven highly effective in translating project outcomes into relatable and actionable information for citizens. This approach not only raises awareness but also strengthens community involvement, empowering citizens to take part in local resilience-building initiatives.

**Unlocking Climate Action**: There is a need to complement data-driven tools with softer alternatives to strengthen climate adaptation and transformation efforts. Within the **REACHOUT** project, several "soft tools" have emerged to facilitate deeper collaboration, co-creation and vision creation. These "workshop-driven tools" help cities unlock potential by building local knowledge, encouraging participation, and empowering communities. Additionally, integrating ambition tools like the Theory of Change/Adaptation Pyramid allows cities to align their climate goals with a clear pathway for achieving them. By combining technical tools with softer approaches and strategic frameworks (such as the Climate Resilient Development Pathways), cities can create more inclusive, adaptable, and impactful climate action plans, ensuring that efforts are both effective and sustainable over time.

The key lessons learnt on **the innovation of tools and services** can be summarized as follows:

**Collaboration and mutual understanding**: Engaging diverse stakeholders early in the co-development process ensures that the tools are tailored to the specific needs of different users, increasing their relevance and effectiveness. Climate stories serve as a key tool for fostering mutual understanding among different municipal departments, promoting collaboration and shared insights.

**User-centric design is key**: Tools that are designed with end-users in mind—whether they are city planners, policymakers, or other stakeholders—are more likely to be adopted and utilized effectively.

**Flexibility and adaptability**: Tools need to be flexible and adaptable to accommodate different contexts, as cities and their challenges vary widely. The ability to adjust the tool to different needs can significantly increase its impact.

**Iterative Feedback (agile co-development)**: Continual feedback loops with users during the development phase help refine tools, ensuring they remain practical, usable, and aligned with evolving needs.

**Gathering of input data**: The city representatives expressed that testing tools and gather input data to set-up the tools is particularly challenging and takes a long time, and it can be easy to lose interest by local stakeholders. The availability of EU and regional level data will be crucial for leveraging tools in other regions/cities.

**Simplifying tools outcomes**: Simplifying complex information and ensuring that tools are easy to understand, and use increases their accessibility and effectiveness in real-world decision-making.

**Documentation**: Comprehensive documentation and easy training materials are vital for ensuring that tools are used effectively, particularly when there is a learning curve or technical complexity. This is why tools are supported by a guidance to show users how to use the tools

## 6.2 Outlook

The ambition of the REACHOUT project has been to provide tools and services to European cities, in line with their needs, also beyond the lifetime of the project. Therefore, a project independent toolkit and market place https://triple-a-toolkit.eu/ has been developed that remains accessible to broker organizations and cities.

There are many other platforms that make a connection with the toolkit. For example, four of the tools were submitted to the tools database, respectively the CRCTool, TAT, Pluvial Flood Tool and the SVI-tool. All of them are now integrated in the database. In the tool description of each submitted tool an explicit reference is made to the Triple-A toolkit and connections to other REACHOUT tools are indicated. As the REACHOUT tools evolve, there might be more tools submitted to the EU MIP4Adapt tools database. A promising candidate to be submitted at a later stage would be FloodAdapt.

Many of the tools in the toolbox will continue to be innovated in the future and the consortium partners will remain active in not only applying the toolkit but also further the lessons learned.

The Triple-A toolkit can offer useful support to communities that want to improve their climate resilience or adaptation plans and intend to apply for funding for example through the EU Mission on adaptation instruments.

# 7 ANNEX I Tools achievements, outcomes and further innovation needs

| Thermal Assessment Tool | | | | | |
|---|---|---|---|---|---|
| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The TAT-heatwave service has been developed as a generic way to categorize and visualize past, present and future evolution of extreme heat episodes (heatwaves) in European regions and cities.<br><br>It relies on public, independent and authoritative Copernicus Climate Change Service (C3S) data, homogeneous across the EU.<br><br>All the data was downloaded from the Copernicus Climate Data Store (CDS): the historical (daily gridded land-only observational) data of the e-OBS and future projections of the EURO-CORDEX dataset, considering the intermediate (RCP4.5) and very high (RCP8.5) emissions scenarios. | User friendly visualization of the evolution of extreme heat episodes (heatwaves) at different regional levels (NUTS2, NUTS3 and LAU) of 7 European city-hubs: Milano, Athens, Logroño, Cork, Gdynia, Lillestrøm and Amsterdam (1981-2100) to raise awareness on how these extreme events are evolving and how the cities/regions will be impacted in the future.<br><br>The clear distinction between baseline records (1981-2010) and last 13 years (2010-2023) provide clear statistics about how climate change is affecting the city/region with regard to the heat stress.<br><br>The plots provide information about the evolution of the heatwave's intensity at both night/day per year is helpful as an input for future energy demands in different municipalities.<br><br>The plots providing information about evolution of warning/alarm/alert days and its future frequency evolution is | These outcomes have worked particularly well in combination with other vulnerability assessment tools to assess to visualize heatwave risks. (e.g. Social Vulnerability Tool)<br><br>These outcomes have been calculated considering both observations and reanalysis, so that they can be integrated with other research tools. | Input data for REACHOUT cities is integrated in the tool, so users don't have to upload any data.<br><br>Easy-to-use interface and self-explanatory visualizations that allow non-expert users to understand the outputs.<br><br>On-line availability of the service allows easy used as input for policy and planning processes and documents (e.g. SECAPs, or Adaptation Plans), or as an input to assess health impacts or energy consumption patterns. | Public datasets are available for an easy replication in continental Europe, with a limited effort needed.<br><br>Heatwaves characterization derived from observations and climate projections to assess thermal behaviour of regions in Europe (1981-2100).<br><br>Heatwaves characterization derived from reanalysis and climate projections to assess thermal behaviour of regions in Europe (1981-2100).<br><br>The heatwave service has been developed as a "software as a service" so will be accessible for other interested EU cities. | The input variables used are maximum and minimum daily temperatures. So further improvements on heatwaves definition and model based on additional variables (relative humidity, wind, etc) could be considered. |

| | | | | | |
|---|---|---|---|---|---|
| | usable for the design of action plans, particularly in relation to the Heat Health Warning Systems. | | | | |
| The TAT-heatmap service relies on a generic methodology developed to generate Land Surface Temperature maps derived from earth observation data.<br><br>The input data used by the current version of the dataset came from Landsat 8. All the images acquired since 2013 by this satellite for Milan, Logroño and Athens were downloaded and processed to characterise not only the current (2019-2023) thermal behaviour of the city, but also its evolution considering the last seven 5-year windows.<br><br>- 2013-2017<br>- 2014-2018<br>- 2015-2019<br>- 2016-2020<br>- 2017-2021<br>- 2018-2022<br>- 2019-2023<br><br>The input data used in this dataset come from Landsat 8 downloaded from Earth Explorer (usgs.gov). | This service allows to visualized the thermal behaviour of the city by providing information on the Mean Annual LST – MAST**,** the Yearly Amplitude of LST – YAST parameters that define the annual cycle of the selected city, as well as the Peak LST by selecting a 30-day window centred on the day that the city reaches the maximum LST value.<br><br>This information provides useful information about the behaviour of a citiy's surfaces and materials. This has implications for several applications such as urban energy efficiency or urban environmental health.<br><br>LST maps was also helpful for hot spot detection for urban planning by integrating theses maps with city-specific vulnerability data. | These outcomes work particularly well in combination with other vulnerability assessment tools and can also be integrated with other tools to support effective locations for interventions. | Input data for REACHOUT cities is integrated in the tool, so users don't have to upload or process any additional data.<br><br>The usability of the tool is very high as the outcomes are on-line available. | The input data come from Landsat 8 downloaded from Earth Explorer (usgs.gov), so additional exercise can be performed for any other city, with a limited effort needed.<br><br>The heatmap service has been developed as a "software as a service" so will be accessible for other interested EU cities. | Identify further relationships between urban morphology and LST patterns<br><br>Monitoring by analyse areas that have changed between periods (this can lead to the assessment of the effectiveness of NbS)<br><br>Better understanding of land and space uses during heat episodes in summer |

| Social Vulnerability Index tool (SVI-tool) | | | | | |
|---|---|---|---|---|---|
| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The SVI-tool has been developed as a generic hazard index and as a hazard specific index.<br><br>The tool compiles inhabitant census data for a robust set of social, economic and environmental indicators such as housing quality, unemployment rate, social networks and average education levels (amongst others) to analyse the vulnerability of a given community to climate change.<br><br>It also uses other EU-level data, such as Copernicus Climate Change Service (C3S) data, to provide insights into the environment, such as tree cover or impervious surfaces, which can also be pertinent to social vulnerability. | The tool outputs maps of the area that are highlighting social vulnerability to a chosen environmental hazard, ranging from extremely high to very low vulnerability. This data is available as shapefiles for the highest resolution available from national census data. This supports users to assess a community's vulnerability to climate hazards and impacts such as flooding and extreme heat events.<br><br>The mapped outputs can be used to inform decision-making on climate adaptation and resilience building, targeting areas that are both social and environmentally vulnerable to climate change as a priority for action.<br><br>The SVI-tool has been implemented for all regions, provinces and municipalities in Ireland, with most recent updates for Cork City. The tool has also been implemented in the La Rioja region of Spain, including the city of Logroño, and in the Lombardy region of Italy, including the city of Milano.<br><br>In Cork the tool is being used as a part of a feasibility assessment to select the location for a new city park and which communities would benefit most. It is also being used as part of the 2025 climate change risk assessment for Cork City, to enable | The census data can be integrated with other tools to provide useful information for planning and monitoring interventions for climate action.<br><br>The tool has been integrated with the Thermal Assessment Tool to consider the vulnerability of populations to heat hazards and with the FloodAdapt tool to consider the vulnerability of populations to coastal; and fluvial flooding.<br><br>To identify and assess the various co-benefits of different nature-based solutions, the SVI could also be integrated with the Pluvial Flood Tool. While integration of the SVI with the Climate Resilient City Tool (CRC-Tool) would allow for social vulnerability to be considered in wider climate action and urban development. | This tool allows decision-makers to visualise areas of the city and populations that are most vulnerable to flooding or heat hazards.<br><br>The tool is designed so that users with basic coding skills can utilise the tool. It is completely opensource, with the codes available in GitHub and step by step guidance available in Juypter Notebooks for users to replicate the maps or adapt the tool to their own needs.<br><br>The use of national census data which is widely collected and generally freely accessible to all users, allows for comparison of social vulnerability in different regions within a country.<br><br>The SVI also uses Copernicus Climate Change Service (C3S) environmental data which is regularly updated and | To encourage long-term adoption, new indicators available at the local level are being integrated to make the SVI even more robust.<br><br>Aggregation of data into different spatial boundaries, that can support current urban development plans has also been trialled in Cork City. These differ from the spatial boundaries used in the census data collection but allow users to integrate data only available at lower resolutions or for different spatial areas<br><br>The focus on combining indicators of social vulnerability with specific environmental hazards and climate action measures can support a just and equitable climate transition.<br><br>The SVI tool is applicable in all areas where census data and environmental data are collected, both in the EU and globally. It is customisable dependent upon user expertise in coding. With basic coding skills the current | Research on additional EU-and local level data to account for different climate hazards, such as wildfires and coastal erosion.<br><br>Inclusion of energy poverty indicators to allow for the creation of energy poverty maps.<br><br>Qualitive data integration for indicators that are not currently mapped quantitively.<br><br>The inclusion of future modelled hazard risks within the SVI tool. |

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| | the social and environmental aspects of climate impacts and climate action to be considered in tandem.<br><br>In Logroño the SVI tool has been used in urban planning by integrating measures of vulnerability with TAT-heatmaps to determine extreme heat risk in the city.<br><br>In Milano the SVI vulnerability maps are being used to raise awareness of the vulnerability of different areas of the city to extreme heat. | | freely accessible to users as well. | template can be applied to any area, however with more advanced expertise in coding the framework can be adjusted to local priorities and a variety of data sources. | |

| Pluvial Hazard, Risk Assessment and Adaptation Tool (Pluvial Flood Tool) | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The Pluvial Flood Tool is designed to assess flooding associated with intense rainfall in urban settings (pluvial flooding) and estimate benefits associated through the implementation of disaster risk reduction and climate adaptation solutions.<br><br>It provides a quick assessment of pluvial flood risk hotspots and supports the prioritization of areas for adaptation solutions and associated risk reduction, focussed on nature-based approaches.<br><br>. | The tool generates high-resolution maps of pluvial flood maximum water depths and associated economic building damage and population exposed. Historical climate, land use (including greening) and socioeconomic conditions as well as projected changes can be considered in modelling framework to help inform disaster risk reduction and climate change adaptation planning.<br><br>Athens is using the tool to prioritize green conversion of impervious areas to reduce current and future pluvial flood risk and the co-benefit of increasing accessibility to green spaces.<br><br>Gdynia has used the tool to identify pluvial flood risk hotspots and compare the benefits of both green and grey disaster risk reduction solutions.<br><br>Logroño is using the tool to identify pluvial flood risk hotspots and assess planned and potential NBS such as green area conversion and bioswales under current and future climate scenarios.<br><br>Milan is assessing green conversion and pervious pavement solutions to estimate economic damage reduction benefits across the city under the current climate and future climate scenarios. | The tool can be readily integrated with vulnerability assessment tools to assess and visualize risk and to support the identification and prioritisation of solution locations. The Thermal Assessment Tool and the Social Vulnerability Tool can be used to assess the co-benefits of nature-based solutions. Additionally, the modelling system could be integrated with fluvial and coastal flood hazard tools. | Useful information includes the identification of urban priority areas for the potential application of risk reduction measures that address economic damage and population exposure. The effectiveness of nature-based approaches in reducing such damage can be used to inform local authorities and/or decision-makers involved in urban planning, climate adaptation strategies, civil protection, early warning systems, impact-based forecasting, and insurance. The tool is also suitable for research purposes.<br><br>The complexity of the tool varies from low for basic risk assessments to medium/high for the implementation of the greening solutions. | The tool is appliable most urban locations, including in the EU and outside of the EU. It is highly customisable and can be applied considering local priorities and a variety of data sources, including open and European scale (allowing for comparability) or local data at spatial scale of meters and sub-hourly timescale.<br><br>The tool requires knowledge of local urban hydrology and basic computational skills for spatial and rainfall data processing, scenario development, and running of simulations. Data are required to characterise the surface, including elevation, land use, and soil. Sub-daily rainfall data are needed as input, which can include historical and climate change scenarios. To identify and optimize the areas for greening, land use data and a regional and an understanding of local priorities are required. | The tool can be extended to consider additional NBS targeting flood reduction.<br><br>The tool could benefit from the integration of the storm drainage system as well as coastal and river flood maps. Furthermore, the tool could benefit from the direct inclusion of the quantification co-benefits of greening solutions such as heat reduction and community enhancement. |

| **FloodAdapt Tool** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The FloodAdapt offers an integrated modelling system to support communities that are exposed to coastal compound flood events, which can be any combination of storm surge, tide, river floods and rainfall.<br><br>The Flood Adapt Tool couples the computationally efficient flood hazard model SFINCS with the flood impact model Delft-FIAT and a range of post-processing functions to assess, for example, equity aspects and flood risk assessments.<br><br>In REACHOUT, we improved the usability of the tool and enhanced functionalities to support adaptation pathways planning and the impact assessment of new urban development areas. | The tool can help decision-makers and stakeholders to explore adaptation options and to evaluate the effectiveness of measures now and under the impacts of future changes in sea level, socio-economic and climate conditions.<br><br>The output visuals include flood hazard and impact maps, impact metrics and customizable infographics enable decision-makers to understand where flooding will be most prevalent under different climate scenarios and how integrating specific adaptation measures will reduce impacts now and in the future.<br><br>In Cork the tool has been very helpful in visualising flooding scenarios in the city, which allowed users to explore potential flooding and impacts with future adaptation measures or new urban development areas in place. | In REACHOUT, the tool has been used in combination with adaptation pathways to determine adaptation tipping points of different adaptation strategies used in pathways.<br><br>The tool was amended to incorporate data from the SVI-Tool to assess the distribution of flood impacts and potential adaptation benefits across different social vulnerability classes. | FloodAdapt is a desktop-based tool that allows users to interact with state-of-the art flood hazard and damage models through an easy-to-use graphical user interface (GUI) The user can specify events, future projections and flood risk mitigation strategies in the GUI. FloodAdapt automatically creates and visualizes flood and impact maps, scenario comparison visualizations, summary metrics, and infographics. | The tool needs to be locally configured for each new site. Setting up the underlying flood hazard and damage models requires data on the terrain, exposure and vulnerability. The effort depends on the complexity of the site.<br><br>Additional tools to help set up FloodAdapt and the underlying models are available, and trainings can be offered. | Better support for adaptation pathways development.<br><br>Adding more adaptation options such as insurance policies and coastal Nature-based Solutions, which require the addition of a wave model.<br><br>Adding a cascading impact model to assess critical infrastructure networks.<br><br>Building a web-based tool. |

| Climate Resilient City Tool (CRCTool) | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The CRCTool explores the spatial planning of adaptation options (mainly nature-based solutions (NBS) in an urban district.<br><br>It uses a conceptual urban water balance model to calculate the hydrological effects of solutions that are drawn in by users.<br><br>The tool supports open adaptation discussions amongst stakeholders, based on a visually intuitive environment.<br><br>The tool provides information on the hydrological effectiveness and an indication of the construction and maintenance costs.<br><br>The tool was configured based on European datasets, supplemented by expert judgement.<br><br>The tool was developed to show the distinction between interventions taken on public and on private land. | The tool produces a map with the selected adaptation options drawn into it.<br><br>The tool indicates the local hydrological effect of the Nature-Based Solutions (change in infiltration, evaporation, surface runoff), as well as values regarding heat stress reduction and construction/maintenance costs.<br><br>The results are shown visually on a map (usually on a district scale), and in a table. The results are calculated instantly on the map and in the table – there is no wait time.<br><br>In Athens; it has been used twice: 1) in an urban rehabilitation workshop for the Votris project area, and 2) for heat stress adaptation in collaboration with the Cooling Havens initiative.<br><br>In Gdynia for an online urban densification workshop. Gdynia acquired the capability to generate forecasts for flooding in local planning areas, aiding in spatial planning analysis. It also enables the examination of whether the implementation of flood risk management and implementing NBS solutions. This insight is valuable for decision-making and optimizing resource allocation in flood-prone regions. | In terms of integration, the tool works particularly well in combination with other vulnerability assessment tools to assess and visualize urban heat island hotspots.<br><br>It is connected to other tools and frameworks through the REACHOUT Triple-A toolkit. For instance, the heat maps of the Heat Assessment Tool and the vulnerability maps of the SVI-Tool can be inserted as a layer into the CRCTool. | It can be used on a computer to explore and compare adaptation options, or on a touchscreen for the co-creation of urban designs with stakeholders.<br><br>Users can easily draw adaptation measures on a map interface and observe effectiveness in achieving adaptation targets, like cooling and pluvial flooding. | Once the tool is configured, it is open and free to use. The configuration costs about 15k EURO for one project area; every extra project area adds 5k EURO.<br><br>For preparing the tool and configuring the hydrological water-balance model, several datasets are required. Long precipitation and evaporation time series and land use maps can be taken from free EU-wide datasets. These must be complemented with local data on soil and groundwater characteristics, open water and drainage capacity.<br><br>If local data is not available, the tool allows the integration and use of European datasets. | Implementation of estimate costs in local currencies.<br><br>Adding climate mitigation measures (carbon sequestration).<br><br>Improving biodiversity co-benefits KPI's.<br><br>Expanding heat stress capabilities to be able to calculate spatial cooling effect based on the TAT output. |

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| | In Lillestrom; it was used to introduce NBS to stakeholders. | | | | |

| **Real Estate Asset Climate Testing (REACT Tool)** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The REACT tool addresses the 'black box' problem currently present in climate risk assessments for the financial sector by providing a global framework for future costs and benefits of flood protection in urban areas.<br><br>The tool is designed to estimate the risk (in euro/year) for individual assets making use of a simplified risk calculation.<br><br>The added-value of the tool is to go beyond qualitative indicator-based assessments which are often difficult to compare and interpret, while also enable capacity building for climate risk assessments in the financial sector. | The tool gives a quick screening of flood risk in a real estate investment portfolio and can also be used to explore adaptation possibilities at individual buildings.<br><br>The tool attempts to empower data analysts at financial institutions to do their own flood risk assessment and familiarize them with data and methods used for climate risk assessments.<br><br>There is a basic calculation where a generic estimate of the value of an asset is used, whereas the advanced calculation allows for a more detailed approach where the user can specify the value of the asset, and, when applicable, include the elevation of the asset above surface level, presence of floodproofing measures, and changes in flood probability due to climate change.<br><br>This enables analysts to perform risk assessments on their portfolios themselves and allowing for subsequent tweaking and integration in internal process. | The approach of this tool should be considered a first step or screening of the physical flood risk of assets, and not a full-fledged risk analysis for which more tailored flood risk models and input data would be required. | The tool offers simple, open, and transparent insights for real estate managers and policymakers to assess different types of flood risks (coastal, riverine, pluvial) for their assets.<br><br>The tool requires some Geographic Information System (GIS) knowledge, though no extensive GIS or flood knowledge is required. | The ambition is to make this tool widely available in the financial sector to enable the use of open climate data and create a level-playing field in the financial sector for climate risk assessments.<br><br>In the long term, it would be beneficial to develop a portal to quickly scan real estate portfolios, while also addressing the role of different types of input data in the tool.<br><br>The tool is open source available at https://zenodo.org/records/8348391 | Keep using the tool and use their network for a wider uptake of the tool.<br><br>Finetune the technical documentation of the tool and make the tool more user-friendly by adding some "common pitfalls" and steps to guide the user through the tool.<br><br>Develop a portal to increase user-friendliness while also maintaining the flexible approach of the tool by allowing switching between different input data sources.<br><br>Extend the model to other hazards beyond just flooding, such as windstorms or drought (foundation) risks. |

| **Windstorm damage assessment tool (WISC)** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| Windstorms are among the most costly climate extremes in Europe. Estimates of damages mostly rely on post-disaster insurance data, which is often not publicly available. It is therefore difficult to model and assess windstorm damage. | The WISC model provides an open-source model which gives damage estimates in line with reported damages from previous windstorms. Damage estimates show that the western part of Europe is greatly impacted by wind extremes. | The tool is a stand-alone tool and currently not integrated with other tools in the toolbox, but the outcomes could be considered in the CRDP. | The tool can be of use for insurance companies, real estate investors, policymakers and climate researchers. The tool offers insight into how damage from storms will potentially develop under climate change | The tool currently has a European focus, while extra-tropical storms are mainly relevant for countries that border the North Sea and Atlantic Ocean. Hence, extending the tool to other types of storms will improve the scalability of the tool. | Further steps are taken to more accurately assess damage from extra tropical storms. However, the tool could be extended in the future to also assess other types of storms. |

| **Climate Resilient Development Pathways (CRDP)** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| This tool supports integrated planning and implementation of climate action by integrating adaptation, mitigation and sustainable development objectives into flexible pathways over time.<br><br>The tool is very relevant for connecting with the wider ambitions and goals for the city.<br><br>Flexibility for defining next actions to reach policy targets, and before the consequences of climate impacts are felt. | The outcomes of the tool are:<br><br>(1) get insights into the range of options to achieve resilient urban future(s), in the short to long term and under uncertainties.<br><br>(2) gain insights into synergies and trade-offs between adaptation, mitigation and sustainable development actions.<br><br>(3) it may support breaking silos within planning processes in municipalities.<br><br>**Cork** is using the tool to support flexible integrative planning of mitigation, adaptation and sustainable development through co-developing pathways over time at the municipality level. The outcomes show the synergies and trade-offs between adaptation, mitigation and sustainable development actions, as well as critical decisions Cork is facing in the near to long term to become a resilient city.<br><br>**Logroño** is currently using the tool to support awareness about the potential complementarities or interfering effects among adaptation, mitigation, and sustainable development objectives with the idea to support the development of a common vision and targets considering these thematic areas and plan future city interventions in more integrated manner. | Climate Resilient Development Pathways (CRDPs) aim to integrate different REACHOUT Tools into a flexible pathway over time, while considering deep uncertainties regarding climate change, as well as other sources of uncertainty. CRDPs support integrated urban planning and implementation of climate action.<br><br>Examples of tools that were integrated in the CRDPs for Cork/Logrono: TAT, FloodAdapt, SVI-Index, Pluvial Flood Tool. | The tool is particularly useful for strategic urban planning departments that wish to understand how short-term decisions affect longer-term options. The tool outcomes can be integrated in urban planning documents and practices.<br><br>In addition, the tool has been helpful in bringing together a wide group of internal stakeholders in the municipality and facilitating a discussion on hazards and solutions that will have cross-sectoral impacts with regards to urban development and climate adaptation. | Inclusion of detailed pathways that consider all current and future goals for Cork across mitigation, adaptation and development. This should highlight all the benefits and trade-offs of different actions. | This approach was developed within the REACHOUT project. Further applications are envisioned to continue developing the tool, e.g. in the Maastricht Municipality in the Netherlands. |

| **Crowdsource module for climate hazard mapping** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| The cities interested in the Crowdsource module for climate hazard mapping already had ArcGIS licenses in place, which simplified the tool's implementation. As a result, the focus shifted towards practical application. | In Cork, the tool has been utilized by students to encourage active learning, like described in a publication*, co-authored by Koen Veenenbos and Sophie van der Horst from Climate Adaptation Services.<br>In Lillestrøm, it was employed to validate data following a flooding event. | This tool is versatile and can be applied to any context or topic. While developing the tool is an important first step, effective communication to engage and gather input from citizens or other users is even more crucial. | The tool is useful and easy to use by the users, but the city needs the human resources to analyse the data collected by tool users. | With the tool up and running, scaling it becomes easy. However, its long-term success depends on your ability to engage the public and encourage them to provide input. | There is no operational use planned at present, however, this could be a useful tool for awareness raising and positive stakeholder engagement. |

* Holloway, P., Thelen, S., McCullagh, D., Tangney, P., Veenenbos, K. R., van der Horst, S. V. J., … O'Leary, N. (2025). Smartphone GIS: exploring technological competency in active learning across geography. *Journal of Geography in Higher Education*, 1–22. https://doi.org/10.1080/03098265.2024.2443908

| **Climate Impact Diagrams** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| Impact diagrams are a decision-support tool designed to help policymakers foster a shared understanding among city stakeholders about the opportunities and risks of climate change across various urban sectors. These diagrams have already been widely applied and tested.<br><br>The innovation lies in the development of a tool that visualizes these impact diagrams, enhancing their clarity and usability. In addition, we trained local partners in Logrono to organize the workshop. | They offer a visual summary of the climate change impacts by sector (economic, social and natural) in order to contribute to the development of adaptation plans.<br><br>Impact diagrams can help cities and city staff to gain insight into the opportunities and risks of climate change for their own field of work, and can enable focussed discussion between stakeholders about adaptation options and priorities.<br><br>This tool has been very useful to address the heat, flood and drought challenges in Logroño, as different impacts have been identified by policy makers and other stakeholders. These outcomes were used as an input for the SECAP as part of the Logroño climate story. | The Impact Diagrams are saved in an excel file and can also be visualized with an online tool.<br><br>The only technical requirement for integration is to allow the city-hub to update and manage this online tool. | The outcomes were very relevant for the policymakers: both the content and the way they are visualized. | For the long-term adoption, it would be good to revise and update them (periodically).<br><br>As guidance material is available on how to organize these workshops, it can be easily scaled. | Improve the online tool by allowing the possibility to update the content of the Impact Diagrams, add literature and background information to the impacts. |

| **Climate Stories Tool** | | | | | |
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| **Key research and innovation achieved** | **Outcomes/Impacts** | **Research outcomes (key learnings)** | | | **Further innovation** |
| | | ***Integration*** | ***Usability*** | ***Scalability and long-term adoption*** | |
| Storytelling is a technique that can be used by climate adaptation practitioners to raise awareness about climate threats and planned solutions, or motivating people to take action. The Climate Stories Tool is a methodology for creating climate adaptation stories, which may be used by practitioners and city administrators to develop their own climate stories.<br><br>The innovation achieved in REACHOUT is the methodology itself, which was developed, evaluated and refined using the examples of the climate stories developed for six European cities in the REACHOUT project. The methodology is presented in a guidebook which is free and publicly available for downloading. | The outcome from the REACHOUT project is the presentation of the developed methodology in the practical guidebook.<br><br>To categories of impact have been achieved:<br><br>1) The six climate stories have been created using the method, and these are in use by the cities in their activities to increase the impact of the climate message, making people feel what climate risks are in their cities, and calling for action.<br><br>2) The co-creation processes used by the Climate Story Tool method have had the effect of increasing awareness and improving communication *within* the city municipalities, where climate adaptation responsibilities are often spread across different sections or groups in the municipalities. Improving communication and understanding between these groups benefits the collective climate adaptation efforts of the city | A significant challenge was to find ways to incorporate the results and products of other tools into the climate stories. Often these tools produce technically advanced results, requiring some expertise to use the tools or understand the results. Extra work was necessary to create infographics, maps and other products to form the results into a context that could be understood by the target audiences (in REACHOUT: ordinary citizens and decision makers) | There are no specific technical or practical barriers – Stories can be told using many different techniques or platforms.<br><br>The Tool is a *method for developing stories* that can be shared with others.<br><br>The involvement of stakeholders during creation of the story is key to success, as this ensures that the stories have an appropriate focus, objective and style for the intended audience. | The Climate Stories Tool as a method *to create stories* is infinitely scalable. Any person or group can apply the method to create a story for topics they are knowledgeable about, and which they have a clear objective they want to achieve.<br><br>The story can be created and then shared using a suitable communication platform or technique, for example using various software platforms (GIS based tools, videos, podcasts, presentations). | For the Climate stories tool: Investigating and testing other narrative forms, and exploring alternative communication platforms for sharing climate adaptation stories. For example, artistic methods such as short stories, sketches or interpretive dance may be creative ways to share information about Climate Adaptation that could reach new audiences or convey the message with a different type of impact or understanding.<br><br>For climate service providers: Developing new products and data sets that are adapted for communication at different technical levels, for example meant for experts, for decision makers, for average citizens. |

# 8 Annex II. FAQs

## 8.1 Triple-A Toolkit

### *What is the Triple-A Toolkit, and how does it help with climate adaptation?*

The Triple-A Toolkit is a digital marketplace designed to support climate adaptation and resilience planning. It provides data-driven and workshop-driven tools and services that help policymakers, urban planners, researchers, and communities assess climate risks, identify vulnerabilities, and develop adaptation strategies. The toolkit covers topics such as flooding, heat stress, financial impacts, and social vulnerability, offering insights to facilitate evidence-based decision-making.

### *What is the Triple-A approach?*

Triple-A stands for Analysis, Ambition, and Action. Unlike fixed step-by-step guidelines, the Triple-A framework offers a flexible approach that can be tailored to local contexts, engage diverse stakeholders, and foster ambitious, climate-resilient cities.

This approach includes activities such as:

Understanding climate change impacts,

Setting adaptation goals,

Identifying and evaluating potential solutions,

Planning and implementing effective actions, and

Learning from the process.

The Triple-A framework helps urban planners and climate adaptation practitioners better understand risks and opportunities associated with climate change, prioritize adaptation measures, and develop robust strategies to make their cities more resilient.

### *Who can benefit from using the Triple-A Toolkit?*

The toolkit is beneficial for a wide range of users, including:

Local governments & policymakers – To assess climate risks and plan adaptation measures.

Urban planners – To integrate climate resilience into city development.

Researchers & academics – To analyze climate data and trends.

Citizens & communities – To understand local climate risks and advocate for solutions.

Insurance companies & financial institutions – To evaluate climate-related financial risks.

### *Who developed and now manages the Triple-A Toolkit?*

The Triple-A Toolkit was co-developed and applied in the REACHOUT project, with seven city hubs implementing the Triple-A Approach. As a legacy of the project, the toolkit is now managed by Climate Adaptation Services and Deltares.

### *Is there training available for using the toolkit?*

The Triple-A Toolkit offers multiple training resources, including:

Online tutorials and webinars to help users navigate the platform.

User guides and manuals for the tools.

### *How can I provide feedback or contribute data to the toolkit?*

Users are encouraged to provide feedback via the Contact page on the Triple-A Toolkit website. Your feedback helps improve the toolkit and ensures that it remains relevant for climate adaptation planning.

For questions about specific tools, you can contact the person listed on the Tools page.

## 8.2 Climate Hazards, Vulnerability and Risks

### *How is my region impacted by flooding?*

The Triple-A Toolkit provides several tools to assess flood impact:

Pluvial Hazard, Risk Assessment, and Adaptation Tool – Helps local authorities explore pluvial (rain-induced) hazard and risk from extreme weather events.

Flood AdaptTool- is a decision support tool that assist local and regional agencies to understand their flood risk under different future conditions. It can be used to assess compound flooding (combination of marine, rainfall and riverine flooding)

Climate Resilience City Tool - it contains a database of over 50 adaptation measures based on which assist the development of local climate adaptation plans and strategies to increase urban climate resilience.

Crowdsource Module for Climate Hazard Mapping – Visualizes publicly generated climate data on digital maps.

REACT Tool and GlOFRIS model – Provide insights into direct flood damage from riverine and coastal floods.

Dynamic Integrated Flood Insurance (DIFI) Model – Analyzes flood insurance premiums, affordability, and coverage demand under different systems.

Social Vulnerability Tool - assesses how communities are affected by flooding. It helps policymakers and urban planners identify at-risk populations and prioritize adaptation measures to protect vulnerable groups.

### *What are the financial impacts of climate change on my region?*

The Triple-A Toolkit helps assess financial risks related to climate change:

REACT Tool and GlOFRIS model - estimate direct flood damage as result of riverine and coastal floods. This tool can be used to guide investments in flood adaptation by showing the economic benefits of several adaptation options, such as flood protection or risk-reducing strategies on the building level.

Dynamic Integrated Flood Insurance (DIFI) Model evaluates insurance premiums, affordability, and demand for flood coverage.

### *How do I determine the historical and future heat stress for my area?*

The Thermal Assessment Tool provides a user-friendly means of visualizing past, present, and future extreme heatwave events in European regions and cities. The tool processes historical records and future climate projections to offer an added value assessment and better understanding of the heatwave events in terms of their duration, frequency, intensity and associated risk. Additionally, the tool provides a high-resolution land surface temperature maps (30 meters) as a way to characterize the heat phenomena at city level.By analyzing temperature trends and extreme heat events, this tool supports adaptive capacity building and climate adaptation planning.

The Social Vulnerability Tool assesses how communities are affected by extreme heat. It helps policymakers and urban planners identify at-risk populations and prioritize adaptation measures to protect vulnerable groups.

***How are vulnerable groups affected by climate change in my region?***

The Social Vulnerability Tool assesses how communities are affected by climate hazards such as flooding, extreme heat, and drought. It helps policymakers and urban planners identify at-risk populations and prioritize adaptation measures to protect vulnerable groups.

***Does the toolkit include tools and services for drought and water scarcity?***

While the primary focus is on flooding, heat stress, and urban resilience, the toolkit includes tools like the Social Vulnerability Tool and Climate Impact Diagrams, which assess how drought impacts communities. Future updates may incorporate additional drought-related risk assessments and adaptation strategies.

***How can the toolkit support my region/city climate risks assessment?***

The Triple-A Toolkit can be a valuable resource for your region or city's climate risk assessment by providing a structured, practical approach to evaluate and address climate risks. The toolkit offers a clear framework that can guide you through identifying and assessing various climate risks specific to your region. By focusing on key aspects such as hazards (e.g., heatwaves or flooding), exposure, and vulnerability, you can assess the potential impacts of climate change on your city or region. See module 2 to learn more about this.

## 8.3 Stakeholder Engagement and Awareness

***How can I engage city stakeholders in climate adaptation efforts?***

The Triple-A Toolkit offers several resources to facilitate stakeholder engagement:

Climate Stories – Uses narratives and visualizations to communicate scientific knowledge.

Crowdsource Module for Climate Hazard Mapping – Allows public participation in climate data collection.

Climate Impact Diagrams – Helps stakeholders understand climate risks and opportunities across different sectors.

Theory of change

Adaptation Pyramid

***How can I raise awareness about climate change and communicate adaptation strategies?***

Climate Stories combine storytelling with visualizations to help stakeholders and citizens understand climate change and adaptation strategies. This method enhances engagement and ensures that climate messages reach diverse audiences.

Adaptation action

***How can I determine my region's climate readiness?***

The Assessment of Risk Management Capabilities Tool helps cities and organizations evaluate their preparedness for climate hazards. It provides a structured approach to reviewing and improving risk management strategies.

***What adaptation measures can I implement at a specific location?***

Several decision-support tools in the Triple-A Toolkit assist in selecting suitable adaptation measures:

FloodAdapt Tool – Supports decision-making for flood risk reduction and resilience-building.

Climate Resilient City Tool – Assists in planning climate adaptation measures and promoting stakeholder dialogue.

RESIN Adaptation Options Library – Assist in identifying and evaluating different kinds of adaptation measures to address climate risks. NBS Catalogue - helps planners and designers in urban areas apply nature-based solutions instead of or alongside traditional approaches.

## 8.4 Communication

***Are there case studies of cities or regions that have successfully used the toolkit?***

Yes! The REACHOUT project applied the Triple-A approach in seven City Hubs: Amsterdam, Milan, Athens, Cork, Gdynia, Lillestrøm, and Logroño.

The Triple-A Toolkit includes case studies showcasing real-world applications such as:

" Expanding despite the floods" – lessons from Cork on managing flooding in rapidly growing urban areas.

"Beating the heat in metropolitan areas" – lessons from Milan and Athens on addressing heat challenges in large cities.

“Partnering with nature to thrive”- How to plan for NbS with lessons from Milan, Athens, Logroño, Gdynia, and Lillestrøm

"Putting climate adaptation on everyone’s agenda" – insights from Logroño, Gdynia, and Lillestrøm on where to begin with climate adaptation.

“Bringing everyone on board” – How to plan climate adaptation among other urban developments with insights from Cork and Logroño

“Protecting People and Investments with Open Data”- Insights from co-developing services with real estate investors lead by APG in Amsterdam.

You can explore the outcomes and lessons learned in the [City Solutions]

***How to improve the communication of climate risk and action?***

The REACHOUT has worked with Climate Stories bridge the gap between scientific research and society. These narratives have been developed for each city-hub and combine scientific insights with storytelling to illustrate how climate change affects cities and t heir residents to get a message across.

See module 6 to learn how REACHOUT climate stories have been developed, how they have been communicated and the level of dissemination they reached within REACHOUT cities and get inspired by the Climate Stories.

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shaping climate resilient cities